

# PROFILE AFV WEAPONS



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## Armoured Personnel Carriers – A Survey

by Major-General N. W. Duncan





# **AFV/Weapons Profiles**

*Edited by*  
**DUNCAN CROW**

When the AFV/Weapons series passed its Diamond Jubilee some time ago with the publication of Profile No. 60, the variety of vehicles covered seemed possibly to be becoming a little confusing even to the series'expert readership. It was for this reason that I thought it might be helpful if I prefaced each new Profile with a few words to let you know which previously published Profiles in the series were relevant to it. Such references, I feel, may contribute to the international comparative history of AFVs and weapons.

Because each Profile concentrates on a particular vehicle (or weapon) or series of vehicles, the place of that vehicle in the overall history of armoured fighting vehicles may sometimes be missed except by those who have also studied the related Profiles. While the relevance is generally apparent from the title, this is not always the case as some Profiles cover a number of vehicles whose names do not always appear in the title. For example, No. 42 (Modern Swedish Light Armoured Vehicles) deals in detail, among other vehicles, with the Pbv 301 and Pbv 302, both of which are featured in the present Profile.

In numerical order, the earlier Profiles which relate to Major-General Nigel Duncan's survey of the history and development of Armoured Personnel Carriers are: 13, 14, 16, 26, 27, 34, 39, 53, and 57. A full list of published titles is given below.

D.C.

## **Check list of published titles:**

- |   |   |   |
|---|---|---|
| 1 Churchill—British Infantry Tank Mk. IV                  | 25 Cromwell and Comet   | 46 Light Tanks M22 (Locust) and M24 (Chaffee)                     |
| 2 PanzerKampfwagen III                                    | 26 Hellcat, Long Tom, and Priest, PLUS Complete Check List of All U.S. World War II SPs | 47 T-34   |
| 3 Tanks Marks I to V                                      | 27 Saladin Armoured Car   | 48 PanzerKampfwagen VI Tiger I and Tiger II ("King Tiger")        |
| 4 Light Tanks M1—M5 (Stuart/Honey)                        | 28 S-Tank   | 49 Japanese Medium Tanks  |
| 5 Light Tanks Marks I—VI                                  | 29 M4 Medium (Sherman)  | 50 Swiss Battle Tanks   |
| 6 Valentine—Infantry Tank Mark III                        | 30 Armoured Cars—Marmon-Herrington, Alvis-Straussler, Light Reconnaissance              | 51 Abbot FV 433 Self-Propelled Gun                                |
| 7 Medium Tanks Mks A to D                                 | 31 Australian Cruiser-Sentinel: and Australian Matildas                                 | 52 M47 Patton   |
| 8 Crusader—Cruiser Mark VI (includes Cruisers Marks I—VI) | 32 M6 Heavy and M26 (Pershing)  | 53 The FV 432 Series  |
| 9 Early (British) Armoured Cars                           | 33 German Armoured Cars   | 54 Japanese Combat Cars, Light Tanks and Tankettes                |
| 10 PanzerKampfwagen V Panther                             | 34 Scorpion Reconnaissance Tank   | 55 Illustrated Summary of German Self-Propelled Weapons 1939-1945 |
| 11 M3 Medium (Lee/Grant)                                  | 35 British Armoured Recovery Vehicles + Wheels, Tracks and Transporters                 | 56 Missile Armed Armoured Vehicles                                |
| 12 Mediums Marks I—III                                    | 36 Chars Hotchkiss H35, H39, and Somua S35  | 57 Schützenpanzerwagen SdKfz 251 SdKfz 250                        |
| 13 Ram and Sexton   | 37 Russian BT Series  | 58 French Infantry Tanks: Part I (Chars 2C, D and B)              |
| 14 Carriers   | 38 Conqueror Heavy Gun Tank   | 59 French Infantry Tanks: Part II (including R35 and FCM36)       |
| 15 PanzerKampfwagen I and II                              | 39 Panhard Armoured Cars  | 60 Russian Armoured Cars (to 1945)                                |
| 16 Landing Vehicles Tracked                               | 40 U.S. Armored Cars  | 61 Elefant and Maus (+E-100)                                      |
| 17 Russian KV and IS                                      | 41 M103 Heavy Tank + M41 Light Tank (Walker Bulldog)                                    | 62 Commando, Twister and High Mobility Vehicles                   |
| 18 Chieftain and Leopard (Development)                    | 42 Modern Swedish Light Armoured Vehicles   | 63 AMX 30   |
| 19 Chieftain and Leopard (Description)                    | 43 PanzerKampfwagen IV  | 64 Armoured Personnel Carriers—A Survey                           |
| 20 Churchill and Sherman Specials                         | 44 Ferrets and Fox  |   |
| 21 Armoured Cars—Guy, Daimler, Humber, A.E.C.             | 45 Vickers Battle Tank  |   |
| 22 PanzerKampfwagen 38(t) and 35(t)                       |   |   |
| 23 Soviet Mediums T44, T54, T55 and T62                   |   |   |
| 24 The M48/M60 Series of Main Battle Tanks                |   |   |





*Into action by APC: the 9th Durham Light Infantry of 7th Armoured Division mounting Ram Kangaroos for the attack on Echt in south-east Holland, January 1945. (IWM)*

# Armoured Personnel Carriers

## —A Survey

by Major-General N. W. Duncan

### THE PROBLEM

AS PRIMITIVE man first stopped an assault by throwing stones at his opponent he created a problem which has bedevilled soldiers throughout the ages: how to cross a missile swept zone without incurring such casualties that the attacking force cannot subdue the enemy when, and if, it reaches him.

The immediate answer was bodily protection: skins, leather, shields of wood or metal, plate mail, link mail, all alike were pressed into service as personal armour; but the crux of the problem was the weight that man or horse could carry. Immunity could only be purchased at the price of immobility and over-protection of the body resulted in reduced movement and assault capability in the case of each individual soldier.

If the soldier could be carried in a protected vehicle his energy would be conserved and he would have personal immunity during the approach to his objective. Man power as a means of propulsion for this mobile fort was obviously inadequate. Suggestions to overcome the problem ranged from a covered wagon propelled by horses inside the vehicle to the use of sails or windmills, although no provision was made for a supply of wind from the right direction or in sufficient strength! One and all these early proposals foundered on the rock of the lack of an adequate source of power, compactly

packaged. For a while high hopes were entertained of the possibilities of using steam, and an armoured, or partially armoured tractor towing trucks which had some armour plate on them, was built in 1900. It was never seriously considered for military use; despite the pleas of its advocates, no real use was seen for it and in any case its cross country mobility was severely restricted by its inadequate power and wheeled drive.

While the need for mobile protection might be recognised by advanced thinkers, the rest of the military world placed its faith in the efficacy of movement under cover of small arms fire: the resultant casualties were accepted as the inevitable price to be paid. The bravest soldiers who were present in the largest numbers usually won. An increase in mobility accompanied by immunity in movement continued to be a pipe dream despite the appearance of the Simms war car at the Crystal Palace in 1902 which could carry 10 men behind its armoured sides. It is true that its mobility was limited by rear wheel drive and inadequate engine power but none the less the germ of the idea was there. Much ill-favoured opposition to the internal combustion engine had to be overcome—for example, the report on the Ruston tractor in 1906 emphasized that "its noise and smell in a column of troops were intolerable and very few horses would pass it".





*German Mittlerer Schuetzenpanzerwagen SdKfz 251/1, the basic medium armoured personnel carrier.*

*SdKfz 251/10, the variant of the German Mittlerer Schuetzenpanzerwagen for platoon leaders which mounted a 3.7cm anti-tank gun.*



## WORLD WAR I—THE FIRST CARRIERS

The missile swept zone, always a problem, became terrifying reality in World War I with the proliferation of the machine-gun covering belts of barbed wire and the resultant ever rising casualty list. A new solution was desperately needed as movement under the cover of fire power proved both impotent and unavailing in face of the continually increasing power of the defence. Ultimately the tank was built; originally, to destroy MG nests and to assist the infantry in their advance. Unreliable as were the early machines they pointed the way to later and better versions and also demonstrated in practical fashion the value of armoured protection moved forward under power. To cross the German trenches which were continually being made wider and deeper the Mark V tank was lengthened by the insertion of an additional bay behind the engine which gave a space of about eight feet in length by eight feet wide and five feet high. At Arras in 1917 this space was filled by Australian machine-gunners with their weapons and gear who were carried up to the battle by the tanks. The fact that the Australian machine-gunners were so ill from the fumes and discomforts of their journey that they were unable to play any part in the action until they had recovered is immaterial: the Armoured Personnel Carrier had taken its first tottering steps on the military stage although it would be many years before the battle transportation drama would be in full production.

After this somewhat inauspicious start infantry were moved forward in small numbers either in sledges towed by tanks in conditions of extreme discomfort or riding

on the outside of the machine where discomfort was replaced by danger. None the less the advantages of using the petrol engine to move men and stores on the battlefield became so obvious that the design and construction of the Mark IX tank, a supply and personnel carrier, was put in hand in 1918. It had a cargo space which was big enough to carry 40 tons of stores or alternatively 40 soldiers—a variation on the French cattle truck with its 8 horses or 40 men. The Mark IX was not completed in time to take part in operations in France and even if it had it is doubtful if it would have fulfilled expectations. Despite the ingenuity of the design it was very underpowered, and with an extremely long length of track in contact with the ground it was difficult to handle. None the less the Mark IX was a promising development and one of them was even made to float by lashing naval salvage “camels” on either side. But the thirty that had been completed by the Armistice were turned into scrap on the reduction of the British Army in 1922.

## THE BRITISH MECHANIZED FORCE

With the disappearance of the Mark IXs, the project of providing armoured protection for infantry on the way to the battle was put back until 1927–28 when the Mechanised Force was operating on Salisbury Plain. A battalion of machine-gunners were mounted in partially armoured lorries while a battalion of infantry were transported in unarmoured vehicles. Since the latter always had to debus in areas clear of the possibility of enemy action they could never arrive on foot in time to take advantage of the opportunities created by the armoured units. The contrast between the enterprising handling of the machine-gunners in their partially armoured lorries as against the delays imposed on the infantry by their lack of any protection was very marked, and although the lessons were to a large extent unnoticed in Britain they were nevertheless very much taken to heart both by Germany and the United States.

## GERMAN AND AMERICAN DEVELOPMENT

The Germans designed and produced semi-armoured three-quarter track troop carriers in quantity, although they were too lightly armoured to be able to keep in close contact with the tanks with whom they were supposed to cooperate and they were always hampered by their limited cross-country performance. Despite a large building programme these carriers were always in short supply: priority for issue was given to the SS divisions but even these favoured formations rarely had more than half their foot soldiers in them the rest having to travel in ordinary lorries. Generally speaking most Panzer divisions had at least one battalion of infantry particularly intended for very close cooperation with the tanks in troop carriers (in the same way that the British armoured divisions had a motor battalion in each armoured brigade) while the rest travelled in ordinary lorries.

The Americans devoted some of their enormous productive capacity to a half-tracked troop carrier. By the end of World War II all the infantry in all the American armoured divisions could be lifted in these vehicles; there were 63 of them to each battalion. But





Two "unfrocked" ie "degunned" Priests on a 51st (Highland) Division route in Normandy, 1944. The pulpit, mounting a .50 cal machine-gun, from which the vehicle got its name was retained in its APC role. (IWM)



A "degunned" Priest in Italy. The 2nd London Irish Rifles on their way to cross the River Reno at the Argenta Gap, April 1945. (IWM)

while the idea was admirable, execution left much to be desired with a vehicle too small for its task in terms of carrying capacity, too lightly armoured and with inadequate cross-country performance to enable it to do what was required of it.

### THE BIRTH OF THE KANGAROO

Prospects for real cooperation on the battlefield appeared very remote until one action in Normandy in 1944 transformed the scene, and produced practical proof that tank-infantry cooperation could be a reality and could be obtained at more than walking pace.

The initiative came from 2nd Canadian Corps under General Symonds in operations across the River Laison south of Caen in August 1944. Priests, which were SP artillery with a 105mm gun mounted on an M3 chassis, were "defrocked", or more accurately "degunned", and the tracked armoured hull converted into a troop carrier with resounding success. The advance, over open ground in face of strong opposition, was covered by tanks and the Priest troop carriers in minimum time. As hostile positions were overcome by the tanks, the infantry, fresh and unfatigued by a long approach, were immediately at hand to take them over and ensure that they gave no further trouble. A difficult task had been carried out at a cost of minimal casualties by really close cooperation between tanks and infantry. The APC was

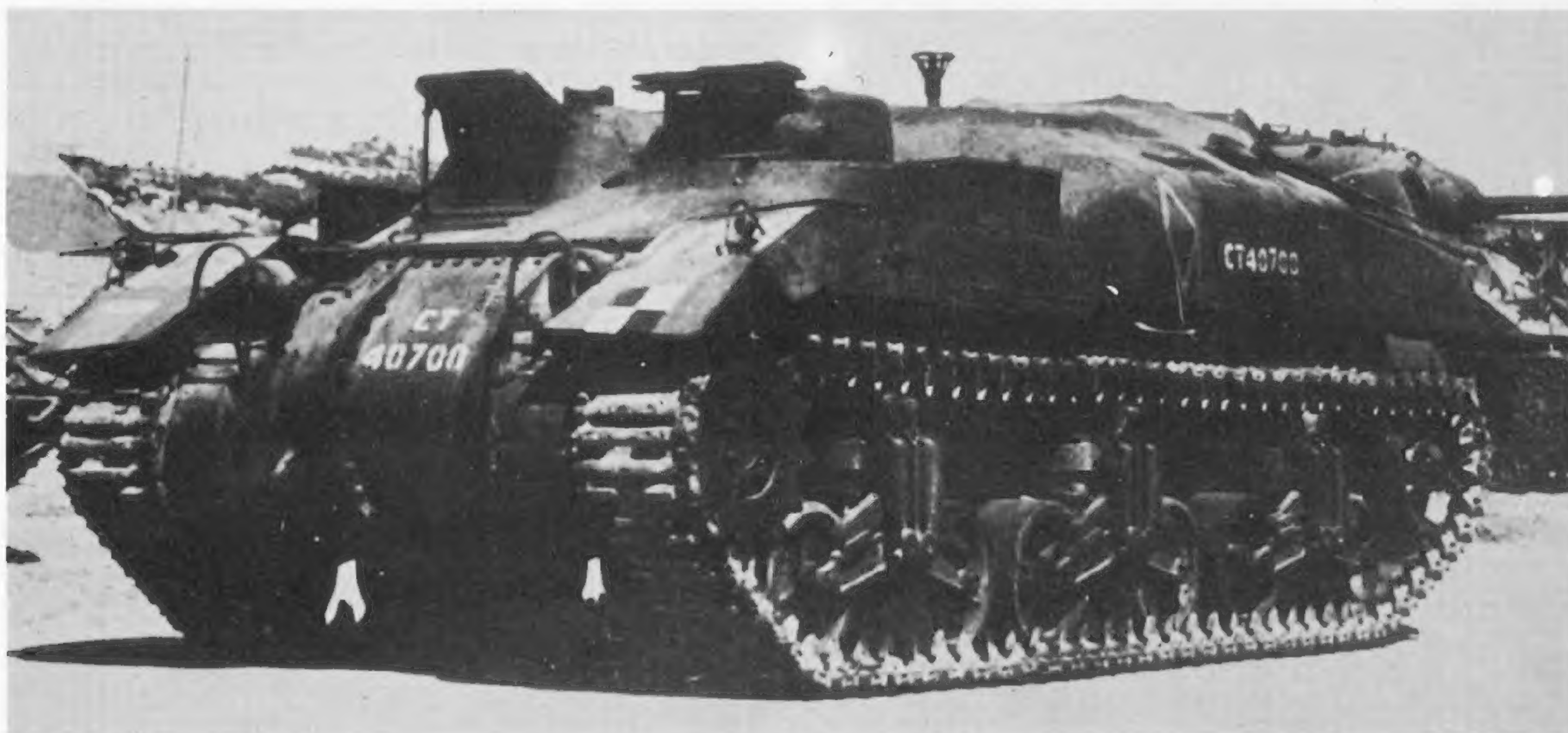
in business and was clearly going to play a part of ever increasing importance during the rest of the campaign.

### THE APC REGIMENTS

Priests were in short supply and eventually the Ram, the Canadian version of the M4 which could not be upgunned because the turret ring was too small, was selected for use as the APC of 21 Army Group. Guns and turrets were removed and the vehicle under the code name of Kangaroo was used to equip the 49th Royal Tank Regiment who were selected for conversion to the carrier role. To conserve mileage and ensure adequate maintenance in view of all the calls likely to be made on it, the regiment was transferred to 79th Armoured Division where it was handled like the other specialist units in that formation.

49 RTR reformed on an establishment of two squadrons each of 53 Kangaroos and each able to lift an infantry battalion of BHQ and four infantry companies. A lot of vehicles were involved so that movement control before and during operations was of prime importance. Tactical handling on the battlefield was easy because the Sherman tank and the Kangaroo had the same armour; where one could go the other could follow subject only to the limitation that the passengers in the Kangaroo had no head cover. A Canadian Armoured Carrier Regiment was formed at the same time as 49

Ram Kangaroo.





RTR were converted and this also came under command of 79th Armoured Division.

The technique of handling Kangaroos in action developed from actual experience on the battlefield and underwent many alterations and changes. Nothing was stereotyped and everything was based on the closest possible liaison between tanks and APCs. Since the latter often had to move on a different line of advance from that of the tanks, the need for some means of self-defence was recognised from an early date. The Ram had a bow gun and to supplement this another MG was mounted on the turret ring. 49 RTR throughout their existence in the Kangaroo role were great believers in the value of prophylactic fire and fixed every gun on which they could lay their hands to their vehicles: their expenditure of small arms ammunition ran to astronomic figures but their casualties were extremely light. The infantry commander and his opposite APC commander travelled side by side in adjacent Kangaroos, control when mounted being vested in the APC commander, subject always to the overriding right of the infantryman to say at any time, "Stop; this is where I get out". However, provided ground conditions were not completely impossible (as they turned out to be at several places, notably s'Hertogenbosch in Holland), the APC regiments regarded it as a grave slur on their efficiency if the infantry had any distance to advance on their feet after disembarking—or, perhaps more appropriately, depouching!

By the end of the war both APC regiments had been continually in action and there was a wealth of experience, both for mobile operations and also for set piece attacks, on which to draw. Short though the time had been since the Kangaroo first made its appearance, it was long enough to allow drills to be laid down for deployment and employment on the battlefield.

Trouble with a big T always resulted from failure to follow established practice. 79th Armoured Division representatives continually encountered proposals from commanders in whose support they were working, to alter the drill, or the establishment, or the organisation of the specialist unit, with entire disregard for the thought, research, and patient experiment which had produced accepted drills and procedures. This irrational unnecessary and irritating work wasted time and involved the expenditure of much energy and trouble to put right. The Kangaroos were assault vehicles handled by specialist troops: they were always in demand and in short supply. It was sometimes very difficult to obtain their release or to convince formation commanders that long moves out of action could be carried out more quickly and with less fatigue in unarmoured troop carriers rather than in Kangaroos which needed as much maintenance as a tank if they were to be kept in action. There was however a growing demand for the inclusion of APCs in the post-war British Army and the situation is best summed up in the words of the Commander of 79th Armoured Division who wrote—

"Although with the present type of vehicle it is necessary to man the Kangaroo with RAC [Royal Armoured Corps] personnel, it is considered that a special type of vehicle should be designed for the infantry. When this vehicle has been produced it should form an integral part of the infantry organisation and be manned and commanded entirely by infantry personnel."

## APCs SINCE 1945

The design of the post-war APC depended on the answers to several questions which had become apparent after an analysis of war-time operations where APCs had been used. Among them were—

i. What was to be the future role of the APC?

Were they to be carriers to the edge of the battlefield, dropping their passengers there and leaving them to fight their way forward at foot pace? This concept was little removed from the old unarmoured troop carrying lorry which had proved so vulnerable to enemy fire and so ineffective in getting the infantry effort to the scene of action at the right time. Alternatively was the APC to carry its passengers to the actual battle, covered both by their own fire and by that of the accompanying tanks? Were they, in other words, to be sufficiently armed and armoured to allow them to fight their own way forward against light opposition even if armoured support was not immediately available?

ii. What was to be the size of the APC in terms of carrying capacity?

To ease the problem of control on the ground after disembarkation the vehicle should hold a tactical sub-unit—a section, a half platoon, or a platoon. The larger the vehicle the fewer would be needed and the less would be the congestion on available routes. On the other hand the larger vehicle inevitably accentuates the problems arising from weight, size, concealment, and also the availability of suitable routes.

iii. What weapons should the APC carry?

The value of prophylactic fire had been amply proved during the war. Was anything of larger calibre than the MG needed? Would APCs ever have to tackle lightly held enemy positions on their own without accompanying tank fire—if so was there a case for the larger calibres, 20mm or bigger? What part would the passengers play when in the vehicle: could their fire ever influence the battle on the move or when halted? Should ports for fire or observation while in transit be provided?

iv. Could tanks be used as APCs on the lines of the war-time Kangaroo?

While offering obvious advantages for spares and maintenance, this suggestion involved the acceptance of little or no head cover for embussed troops and the need for them to go into action over the sides—unless the tank was radically redesigned. Obviously a rear exit was needed and this should both be as large as possible and unencumbered so that the vehicle could be used as a load carrier at need. All this added up to the fact that a special vehicle was needed.

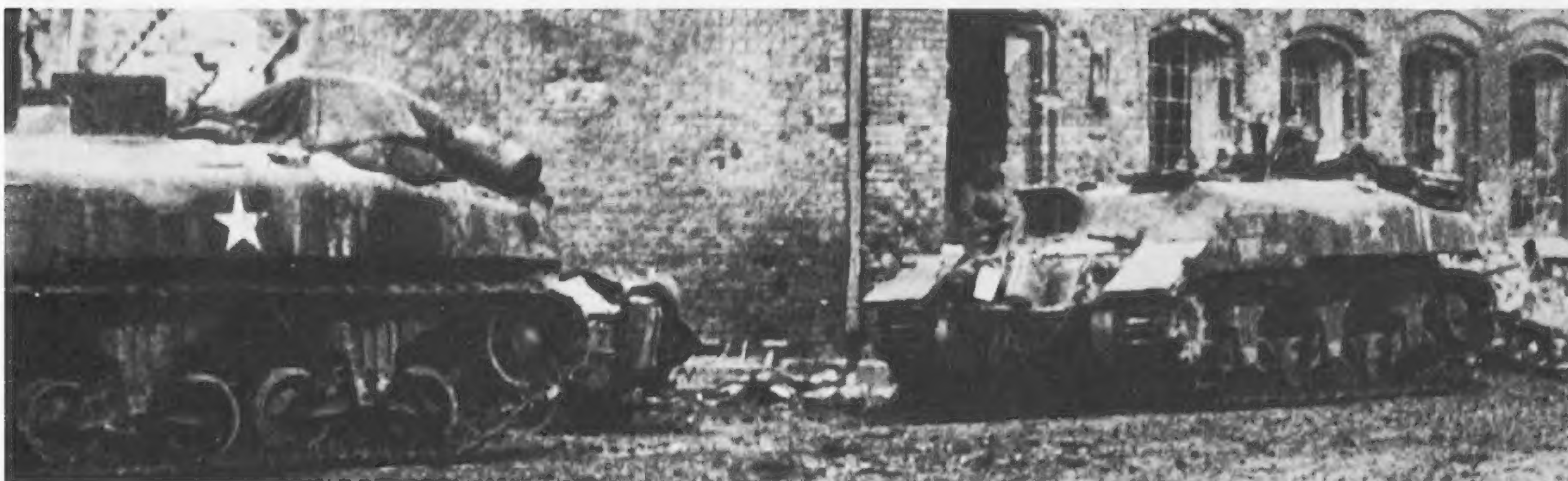
v. What thickness of armour was required?

War-time operations had pointed out the advantages when tanks and Kangaroos carried the same measure of static immunity, but this inevitably meant weight. In turn this prejudiced the chances of another very desirable characteristic—built-in flotation: the ability to cross rivers, lakes and streams without the need for prolonged preparation. In fact if no preparation was needed, operational handling of APCs would be made that much easier.

vi. Would it be possible to achieve any measure of standardisation with other tracked vehicles used by the Army?

Any saving that could be effected in this fashion would be of the greatest benefit in view of the inevitable post-war financial stringency. It is worth noting that the





*Ram Kangaroos of 49th Royal Tank Regiment carrying men of the 15th (Scottish) Division into the attack on Blerick, opposite Venlo, the Netherlands, December 1944. The Kangaroos carried the infantry right into the town. Two Churchills covering the advance can be seen on the left. (IWM)*

*Kangaroos in Germany, 1945. The infantry passengers have dismounted for action in the town. The APC regiments regarded it as a slur on their efficiency if the infantry had any distance to advance on their feet after dismounting.*

*Men of 3rd British Infantry Division mounting a Ram Kangaroo preparatory to the attack on Kervenheim in the Battle of the Rhineland, March 1, 1945. This picture shows the difficulty of using a tank chassis as an armoured personnel carrier. (IWM)*

*The M44 Armoured Utility Vehicle was developed in 1945. Like the M39 it was based on the chassis of the M18 Gun Motor Carriage, the Hellcat. Only a few of these large, cumbersome APCs were built. The M44 could carry 27 men. (bottom right).*

*Restricted routes and bad weather lead to traffic jams. Kangaroos, with infantry aboard, waiting to advance.*



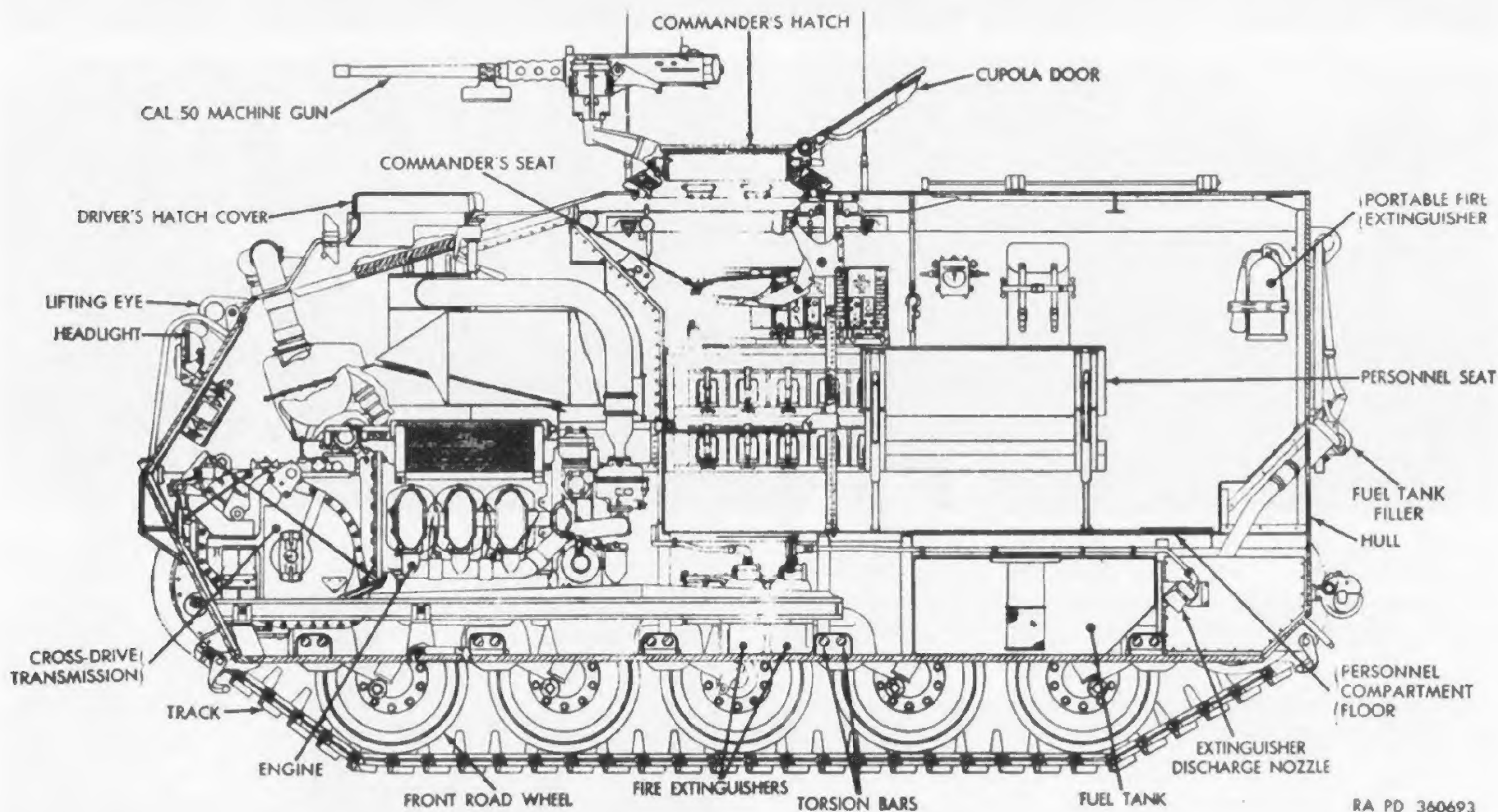




The T18E1 Armoured Infantry Vehicle with cupola mount for .50 cal machine-guns. The T18 was a scaled down version of the M44.  
(U.S. Ordnance Corps)



The T18 came into service in the U.S. Army in 1953 as the M75 Armoured Personnel Carrier. Note the pintle-mounted .50 cal machine-gun.  
(U.S. Ordnance Corps)



Cross section of M75 Armoured Personnel Carrier.

(U.S. Ordnance Corps)

chance of bringing this about in the U.K. had to wait until the advent in 1971 of the Combat Vehicle Tracked (Reconnaissance) which offers promise: on the other hand this has only been achieved by the reintroduction of the light tank for which no place could be foreseen in the post-war range of tracked AFVs.

These are some of the questions that presented themselves, unasked, to planners and designers in the post-war era. Different countries have provided differing answers to the problems and these are discussed in the following sections, country by country.

## UNITED STATES OF AMERICA

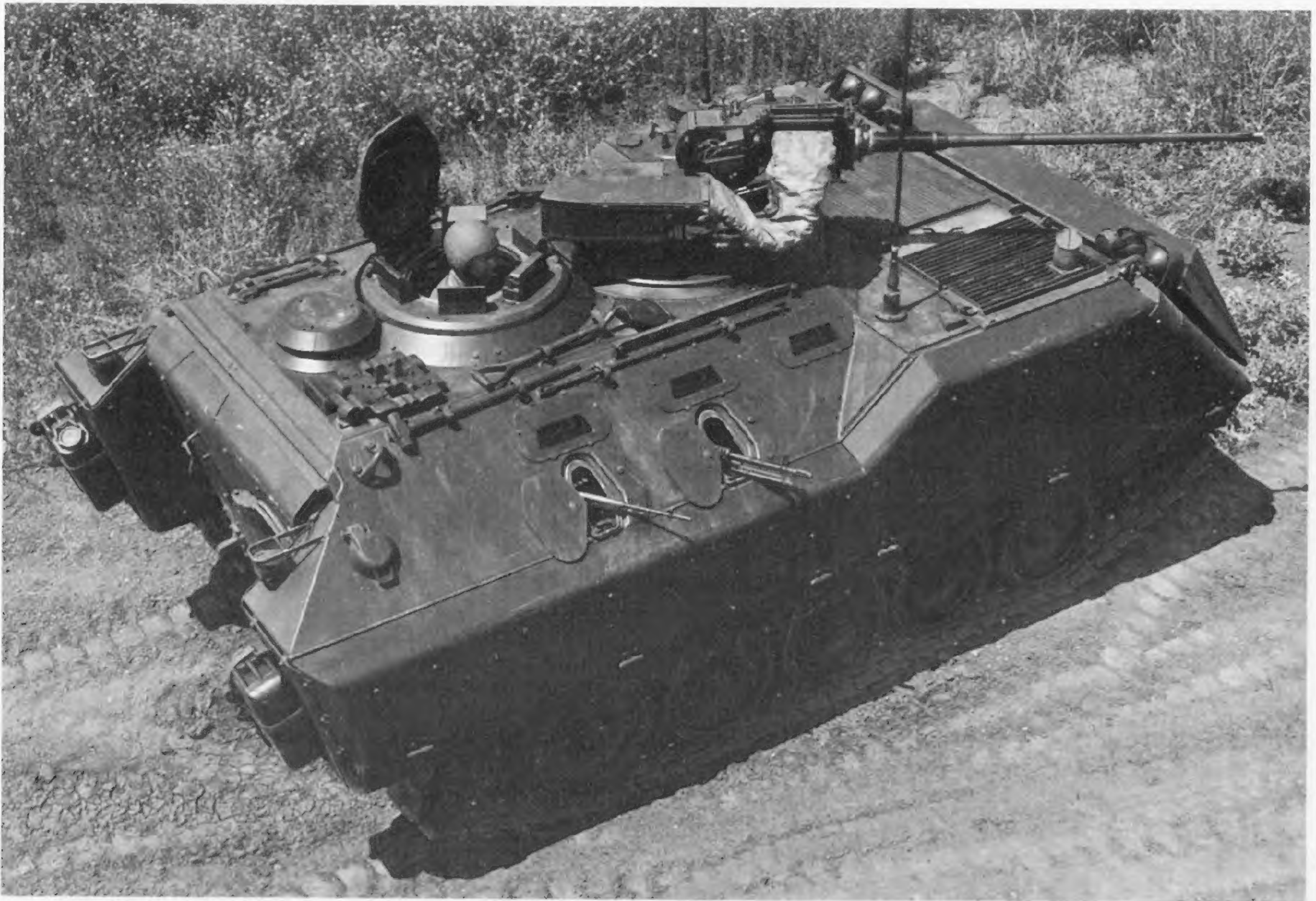
A number of APCs have appeared in America during the past years. Their development has been influenced by U.S. tactical doctrine which made the infantry responsible for fighting their way forward on a battlefield on foot. The carriers' task was to bring the infantry forward as far as possible, then to let them disembark and rely on their own resources. This battle taxi theory has been eroded over the years and carriers have now been built

which are able to operate in mobile operations so that their infantry can be disembarked fresh and untired where they are immediately required, or else can fight from the vehicle itself.

Before the war America had enthusiastically embraced the idea of carrying foot soldiers behind armour and built half-track machines with a nominal load of ten men, in quantities sufficient to lift all the infantry in a U.S. armoured division. The number of vehicles involved was very great and control was always a problem especially since the cross-country performance of these half-track vehicles was limited. During the war, inspired by the successes achieved by British and Canadian forces in Europe, the United States began to develop their own machines. By 1944 an M18 tank destroyer had been stripped of its guns and modified in minor respects, to become the M39 Armoured Utility Vehicle. Meantime no attempt was made to equip U.S. forces in Europe with their own tracked APCs but on several occasions their troops were carried forward by one or other of the APC regiments in the 79th Armoured Division.

Following the M39 the Americans built the M44





*The Product Improved M113A1—no longer a battle taxi but an armoured fighting vehicle. Note the remote-controlled 20mm cannon. (FMC)*

*The M114 Armoured Reconnaissance Scout Vehicle showing the distinctive circular rear door. This vehicle is experimentally fitted with a 20mm Hispano Suiza cannon. (Col. R. J. Icks)*



available cargo space with the attendant disadvantage of loading and unloading cargo or human beings over the side of the craft.

LVT 3 was originally designed for cargo carriage. It used the same tracks and suspension as LVT 2. To get greater cargo space two Cadillac V8 engines together with Hydramatic transmissions, as used in the M5A1 Light tanks (Stuart VI) which had become obsolescent, were installed in the panniers either side formed by the inner and outer skins of the LVT. The Hydramatic boxes were automatic with an overriding driver's control and drove forward to a controlled differential which provided power and steering to each track by lateral propeller shafts. The new location of the power trains immensely increased the available cargo space, access being obtained by a rear ramp running the full width of the craft and which was operated by hand winches. LVT 3 was the craft used by the Americans in their Pacific operations and also after the war: it rapidly acquired arms—a .5-inch MG, mounted immediately behind the armoured driver's cab, was flanked by a .30 MG on either side of the hull. Torsilastic suspension units like those on LVT 2 were used with a track which, at 12 inches wide, was two

inches narrower than that on other LVTs. In contrast to the other versions this track was rubber bushed and less prone to be thrown when worn. Land speed was in the order of 15 mph. while  $7\frac{1}{2}$  could be obtained afloat. The craft could carry 30 passengers or four tons of stores.

LVT 4 was evolved from LVT 2 but had the engine moved forward until it was just behind the driver's cab; it also had a stern ramp of the type fitted to LVT 3. Engine, transmission, suspension and tracks were similar to those of LVT 2; speed on land was 20 mph. and  $7\frac{1}{2}$  afloat. The alterations made it possible to carry 30 passengers or over four tons of stores, including jeeps, 6-pdr. anti-tank guns or field guns. By building ramps to gunwale level it was possible, although a little precarious, to carry a 17-pdr. anti-tank gun. The craft armament remained unchanged although LVT 4 in British hands bristled with every form of gun that could be crammed on to the gunwales.

The United States developed a series of modified LVTs, either armoured or having additional bolt-on armour in kit form: armament was also considerably increased with howitzers or guns of relatively low velocity, installed in turrets taken from tanks. These



an Armoured Reconnaissance Scout Vehicle. It incorporates one particularly interesting feature as standard equipment, a gas filter which can supply purified air to the crew of three and to the other five soldiers the vehicle can carry, each of whom has a flexible hose and a face-piece; an easier solution to the problem than trying to filter air in sufficient quantity to keep up a positive pressure inside the vehicle. The M114, which can be identified by the longer nose plate and the round door at the back, has carried various armaments all of 20mm calibre or larger. A .30 MG is also mounted by the rear hatch. The M114 has not proved as successful as the M113 and is due to be phased out of service in the near future on account of its poor cross-country performance.

Possible replacements for the M113 series are under test.

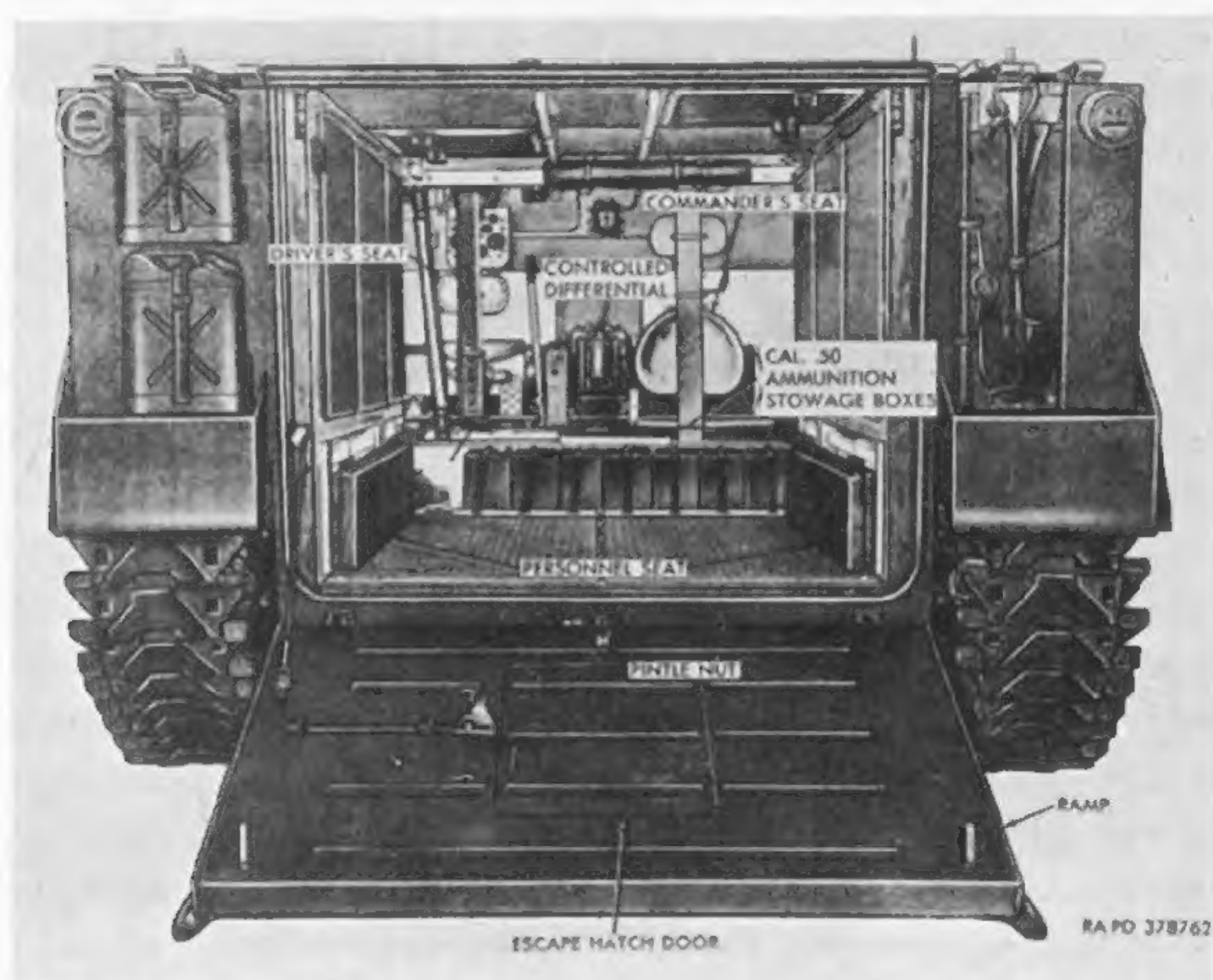
### Landing Vehicles Tracked (LVTs)

No review of American APCs would be complete without some mention of the series of LVTs, primarily intended for amphibious operations. A great deal of work was done on the problem both before, during, and after World War II, more indeed, than by any other country with the possible exception of Japan. LVTs were extensively used by the Americans in operations against the Japanese held islands in the Pacific and also by the British in N.W. Europe.

The LVT story begins in 1932 with the appearance of the Roebling tractor built as a private venture for rescue work in the marshy going of the Florida Everglades. By 1935 this had developed into a vehicle with a speed of 25 mph. on land, but with a poor performance when

afloat. Alterations to tracks and their grousers improved performance until shorter and lighter prototypes culminated in the Alligator which appeared in 1940 with a water speed of 6-7 knots. In November of that year 200 LVT 1, based on the Alligator design, were ordered for use as load carriers; but in service trouble was experienced with the suspension, which was too rigid, and also with the tracks. It is interesting to note that the LVT was originally earmarked as a load carrier and not as a fighting machine; there is thus a curious parallel between the start of the LVT story and that of the original proposals for a tracked machine to carry infantry which culminated in the first tanks of 1916.

LVT 2 appeared in 1943 and was a considerable improvement on LVT 1. It had a better shaped hull with a redesigned track incorporating vertical W-shaped grousers which were held in place by bolts and could be replaced if necessary. These grousers, which were about three inches deep, in conjunction with a special water box at the rear of the vehicle which shed water off the top run of the track, materially improved performance when afloat. On land the story was different; hard going destroyed the grousers and consequently degraded performance when afloat until the wrecked grousers had been replaced. A new multi-wheeled suspension dependent on the torsion induced in rubber bonded to an inner and outer shaft proved most satisfactory and gave remarkably little trouble, while the use of M3 Light tank parts simplified production. LVT 2 was powered by a 7-cylinder Continental radial engine which was mounted at the rear of the vehicle and drove forward to front driving sprockets: inevitably this meant a reduction of



*The M59 had a full width hydraulically operated ramp at the rear instead of the small exit doors of the M75. This drawing shows the ramp dropped and the personnel seats folded. (top left)* (U.S. Army)

*M113 modified at the Infantry School, Fort Benning, to seat carried infantry back to back. It has three left, four right, and two rear firing ports. This vehicle is of particular interest as it heralded a change in U.S. tactical doctrine. Previously it had been held that armoured infantrymen dismounted to fight, their transport being only a battle taxi. Here is the beginning of the change to the doctrine that they either fought from the vehicle or dismounted. This modified vehicle led on to the XM765 (MICV) and the Product Improved M113A1.* (Col. R. J. Icks)

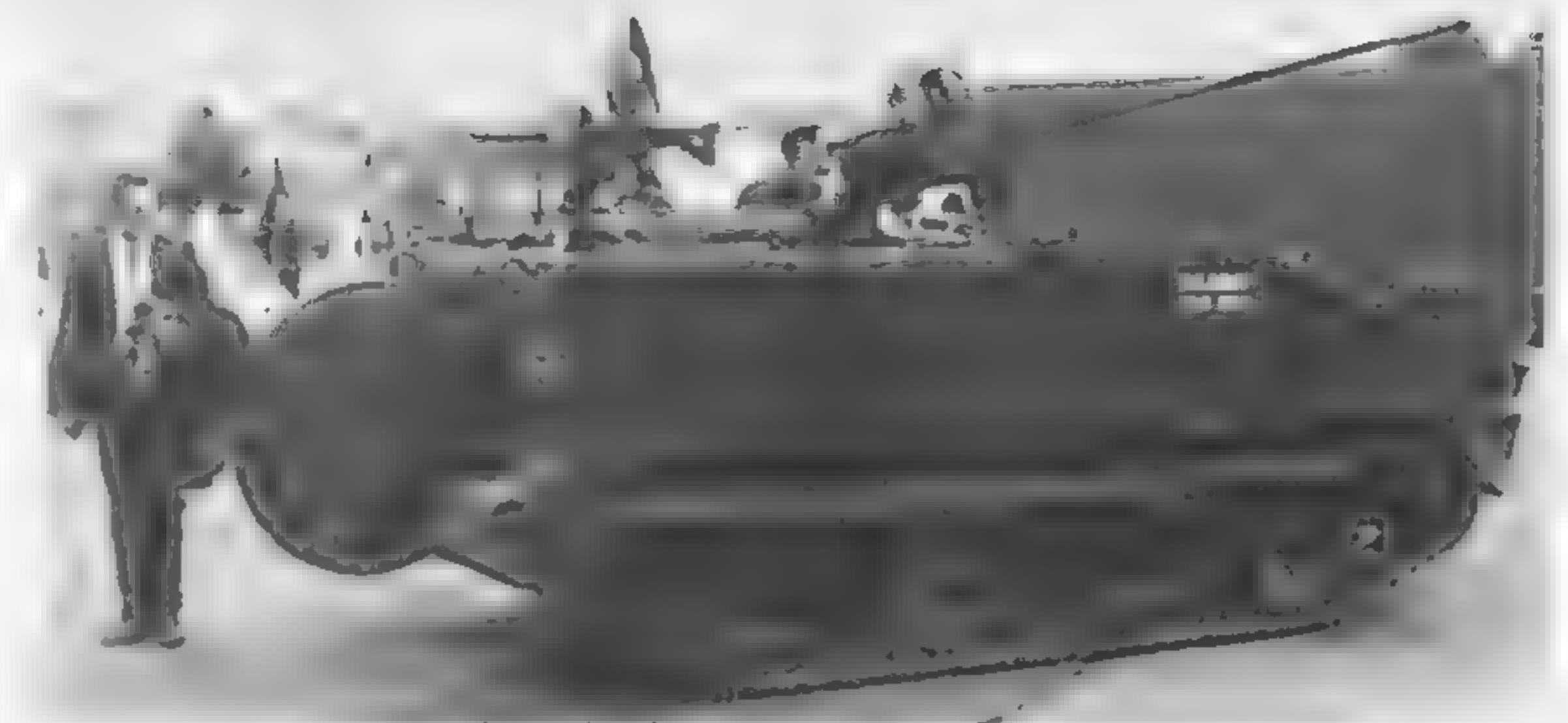
*Rear view of the T113 Armoured Personnel Carrier with its ramp down. Note the seating arrangements for the crew and the transported infantry. Driver's seat is front left, commander's is central, passengers are seated along both sides. Minor modifications were made when this was standardized as the M113. (below)* (U.S. Ordnance Corps)







*The Product Improved M113A1—no longer a battle taxi but an armoured fighting vehicle. Note the remote-controlled 20mm cannon. (FMC)*



*The M114 Armoured Reconnaissance Scout Vehicle showing the distinctive circular rear door. This vehicle is experimentally fitted with a 20mm Hispano Suiza cannon. (Col. R. J. Icks)*

available cargo space with the attendant disadvantage of loading and unloading cargo or human beings over the side of the craft.

LVT 3 was originally designed for cargo carriage. It used the same tracks and suspension as LVT 2. To get greater cargo space two Cadillac V8 engines together with Hydramatic transmissions, as used in the M5A1 Light tanks (Stuart VI) which had become obsolescent, were installed in the panniers either side formed by the inner and outer skins of the LVT. The Hydramatic boxes were automatic with an overriding driver's control and drove forward to a controlled differential which provided power and steering to each track by lateral propeller shafts. The new location of the power trains immensely increased the available cargo space, access being obtained by a rear ramp running the full width of the craft and which was operated by hand winches. LVT 3 was the craft used by the Americans in their Pacific operations and also after the war: it rapidly acquired arms—a .5-inch MG, mounted immediately behind the armoured driver's cab, was flanked by a .30 MG on either side of the hull. Torsilastic suspension units like those on LVT 2 were used with a track which, at 12 inches wide, was two

inches narrower than that on other LVTs. In contrast to the other versions this track was rubber bushed and less prone to be thrown when worn. Land speed was in the order of 15 mph. while  $7\frac{1}{2}$  could be obtained afloat. The craft could carry 30 passengers or four tons of stores.

LVT 4 was evolved from LVT 2 but had the engine moved forward until it was just behind the driver's cab; it also had a stern ramp of the type fitted to LVT 3. Engine, transmission, suspension and tracks were similar to those of LVT 2; speed on land was 20 mph. and  $7\frac{1}{2}$  afloat. The alterations made it possible to carry 30 passengers or over four tons of stores, including jeeps, 6-pdr. anti-tank guns or field guns. By building ramps to gunwale level it was possible, although a little precarious, to carry a 17-pdr. anti-tank gun. The craft armament remained unchanged although LVT 4 in British hands bristled with every form of gun that could be crammed on to the gunwales.

The United States developed a series of modified LVTs, either armoured or having additional bolt-on armour in kit form: armament was also considerably increased with howitzers or guns of relatively low velocity, installed in turrets taken from tanks. These





British Mark IX Tank of World War I. (1918).



*Leichter Schützenpanzerwagen* SdKfz 250, the German light APC. (1940).

American T18 was standardized as the M75 APC. (1951).







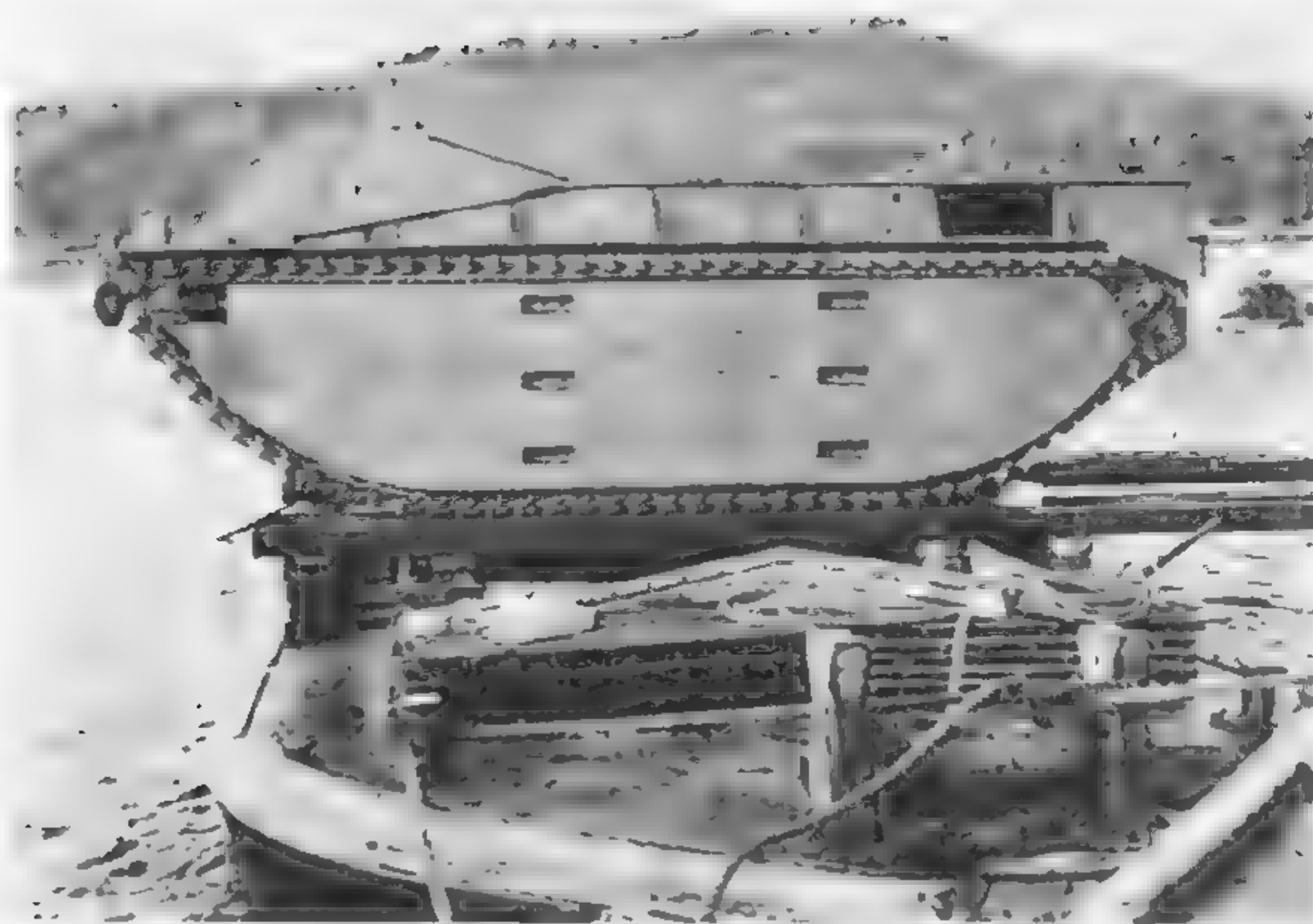
Ram Kangaroo was a de-turreted Canadian tank. (1944).

Swedish Pbv 301 was converted from a tank. (1961).



British Saracen APC. (1952).





*Prototype Alligator on trial.*

*LVT 1 Prototype, showing idler adjustment and the protruding inner skin with angled brackets to support the track guard. Note the original track grousers which threw the water out and rearward.*

modified LVTs were distinguished by the letter (A) in their nomenclature. LVT(A)1 was LVT 2 with the Light Tank M3 turret mounting a 37mm gun; LVT(A)4 was LVT(A)1 with a turret taken from the M8 Howitzer Motor Carriage and mounted a 75mm howitzer; while LVT(A)5 was the same machine and gun as LVT(A)4 but the main armament was fitted with stabilisation gear and power traverse was also installed.

#### **LVTs in the Post-War period.**

By 1949 LVT 3 had had its cargo space covered in to protect the passengers and also had a machine-gun turret installed just behind the driver's position. This was adopted as the standard LVT and was used in the landing at Inchon in Korea supported by LVT(A)5s. While these vehicles were being used in Korea new models were being built in the United States. By 1951 LVT-H6 was in production, a much bigger machine than any of the war-time LVTs, weighing almost 33 tons ready for action as compared with the 15 tons of LVT 4. It is armed with a 105mm howitzer with a coaxial .30 MG in a turret with 360 degree traverse. This machine has a bow ramp and the turret behind the driver's seat occupies the

forward part of the hull. The engine is a Continental V12 liquid cooled, and an Allison cross drive unit provides an automatic gear change and a means of steering.

Externally the appearance shows a marked difference from the war-time LVTs: this one is box shaped and the hull sides come almost down to the suspension wheels, enclosing the whole top run of the track. While this undoubtedly makes for a better performance in the water it does not increase accessibility for maintenance. Track plates, made in steel because the original aluminium versions proved unsatisfactory, are linked to each other by two short pins, rubber bushed. Grousers are triangular in shape and inverted so that they act in a dual capacity—as a means of propulsion when afloat and as a track guide. The outer surface of the track performs well on hard going.

The underwater shape has been considerably modified and the bottom plate is in the form of an inverted V, designed to improve stability at sea. The line of this V is continued up the front ramp until it runs out in triangular shape just below the top. Torsilastic suspension units are used and the tracks are almost 21 inches wide.

LVT-P5 is almost the same vehicle as LVT-H6. It has

*LVT 2 showing the sprocket location, Torsilastic suspension units, and the sloping run of the upper track with the new W-shaped grousers, which gave such an improved performance*





been designed as a personnel carrier and mounts only a .30 MG in the static cupola provided for the commander; 25 to 34 passengers can be carried in addition to the crew. No weapon ports are provided but there are two double spring-loaded hatches in the roof. A number of variations on both LVT-P5 and H6 have appeared in prototype form. In general, speed both on land and afloat has been increased and experimental gas turbines have been tried out. Modifications of the original vehicles provide for recovery, command duties, flame-throwers and mine-sweeping. Out of these experiments and variations LVTP-X12-9 has appeared. This has a turret mounting a 20mm gun and a coaxial MG together with a .5 MG pintle-mounted on the roof. The after part of the enclosed hull is bevelled at the top and is provided with firing ports. The V shape for the bottom of the hull is retained but normal pattern torsion bar suspension with six wheels either side has been substituted for the Torsilastic units. The top run of the track is not enclosed except for a short detachable shroud at the forward end; propulsion afloat is by submerged water jet units which give the 25-ton vehicle a speed of  $6\frac{1}{2}$  knots; land speed is 40 mph. 1970 saw the commencement of small scale production.

### GREAT BRITAIN

The Mark IX of World War I was the first Armoured Personnel Carrier and although it was lamentably underpowered, unreliable and built too late to be used operationally, it indicated the potential of special load carrying armoured vehicles both for men and stores. The 30 that were in existence were broken up for scrap after the war, and although sporadic efforts to produce another tracked carrier were made in subsequent years, nothing of any note appeared until the days of the



*LVT 1 moving under ideal conditions—the soft going at tidemark. Note the diagonal grousers on the tracks.*

Experimental Force in 1927/28. Even then what armoured carriers there were in existence were based on wheeled chassis with half-track devices to increase their cross-country capacity and were not particularly successful.

By 1938 the Bren carrier, tracked and lightly armoured, had appeared in service, intended to carry a Bren gun and its crew. It appeared in various models, carrying up to four men and a commander and by the outbreak of World War II was the standard equipment for motor battalions in armoured divisions. The Bren carrier, which was powered by an 85 hp. Ford engine and incorporated an ingenious sideways movement to the main suspension bogies to provide a means of steering, was developed into the Universal carrier which came out in 1940. There was little external difference between the two. Both were in large scale production and in various guises proved invaluable during the war.

In 1947 the Oxford carrier, developed from the earlier models, appeared with an enlarged body which could

*LVT(A)1: this was an armoured version of the LVT 2 with an M3 Light Tank turret mounting its 37mm gun. Note the crew hatches in the upper superstructure plate and the .30 Browning on a traversing ring.*





carry eight or nine men. No overhead cover was provided and because this model was the ultimate development of something that had outlived its usefulness in its current shape, it never went into large-scale production.

These variations on the original carrier are interesting; they illustrate the inevitable tendency towards an increase in weight and size but they do nothing to meet the demand for an APC capable of fulfilling the tasks carried out by the Kangaroos during the war. Some attempts were made to adapt the Churchill tank chassis for the task but these came to nothing because it was impossible to provide a rear exit.

Provision was made in the post-war FV 300 range of light armoured vehicles for an APC but nothing came of this project since the idea of light armour was itself, at the time, suspect. The light tank undergunned and under-armoured was apparently obsolete but it bobbed up again in the FV 400 range which was to have built-in swimming capacity in all its variants. FV 401 came out in 1954, powered by a 160 hp. Rolls-Royce engine and able to carry seven men who had some overhead cover from hinged screens. Since the engine was rear mounted there was no rear exit and the passengers had to go into action over the sides.

Further progress on tracked machines was interrupted by events in Malaya when an immediate need for a number of wheeled Saracen troop carriers arose. This vehicle on the same chassis as that of the Saladin armoured car, was originally designed to carry the assault troopers in an armoured car squadron and proved invaluable in the Internal Security role. It had a gun turret with a machine-gun, observation for the commander, and could carry ten men in addition to the crew, with firing ports and an externally mounted machine-gun in addition to the one in the turret. A rear exit was provided and this very good vehicle was only hampered by the inevitable restrictions imposed by its wheeled drive.

In 1958 a firm requirement for a tracked personnel carrier was issued and the prototype appeared three years later. FV 432 is now standard equipment for infantry battalions in the British Army. It is powered by a Rolls-Royce B60 engine and uses torsion bar suspension with return rollers. There is a machine-gun turret but no provision is made for the passengers to use their weapons from the vehicle nor have they means of observation when mounted. The vehicle is box shaped with a high silhouette and is built of steel, which makes it considerably heavier than M113, its U.S. counterpart which it closely resembles: weight has been saved in the American version by the use of aluminium armour. Owing to its heavier bulk FV 432 has no inherent buoyancy and to obtain the required capacity it has been necessary to have recourse to a built-in flotation screen in conjunction with a trim vane, hinging forward from the edge of the glacis plate. Water-borne propulsion is obtained from the tracks.

In 1971 came the first prototype of a new APC, a variant of Combat Vehicle Tracked (Reconnaissance). This range of vehicles is intended to replace the current armoured reconnaissance vehicles in the British Army. FV 103 (Spartan) weighs 8 tons and is 5 feet 8 inches high. It has room for seven men, two of whom, a driver and a gunner, would normally stay with the carrier, leaving five men to take dismounted action. A revolving cupola mounting a machine-gun is fitted; this is operated by remote control from within the vehicle. There is a single

rear door and a hatch in the back of the roof. No firing or observation ports have been provided for the crew. Spartan is powered by a Jaguar engine which is front mounted. Torsion bar suspension is used.

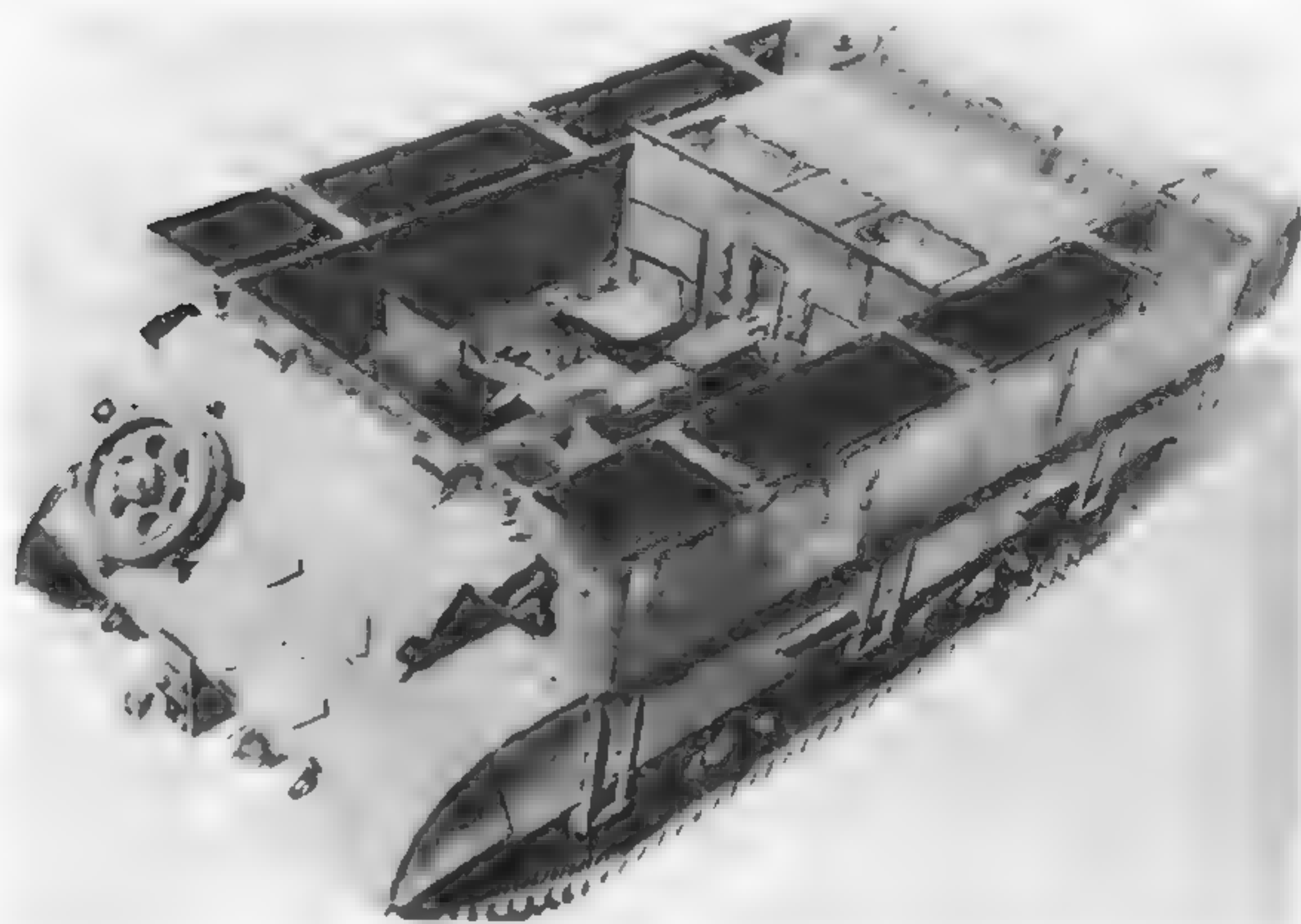
## FRANCE

The French used unarmed Schneider tanks for supply purposes during the later stages of World War I but never envisaged the use of tracked carriers for the movement of infantry or machine-gunners on the battlefield. In 1938 the Tracteur Blindée 38 L (Lorraine) appeared with a prime mover towing a box-shaped, armoured, tracked trailer, but the armoured personnel carrier version never went into production. The defeat in 1940 stopped further development, but when this was over the French turned their attention once more to the problem of armoured transport. By 1957, by evolution from other wheeled carriers, they had produced the EBR Sahara, an eight-wheeled vehicle based on the EBR armoured car, which could carry 14 men.

Any wheeled vehicle has a limited cross-country performance by comparison with one which moves on tracks. The French wanted an APC which could accompany tanks anywhere on the battlefield and was capable of undertaking minor operations against light opposition without tank assistance if this was necessary. The battlefield taxi philosophy found no place in their military thinking and to meet their requirements a prototype Hotchkiss armoured tracked carrier appeared in 1952. It came into service as the Hotchkiss TT6-55 three years later. With 10mm of armour it weighed 6.4 tons and could carry six passengers. Overhead cover was provided and the vehicle had a rear exit: no provision was made for the use of personal weapons from the vehicle although a machine-gun was mounted in the front plate for offensive purposes.

By 1958 production models of an APC to replace the Hotchkiss made their appearance in the shape of the AMX VTT, which was built on the chassis of the AMX 13 light tank, which has a front-mounted engine. What distinguishes this carrier from many others is the provision made for the passengers—it can carry 10—not only to observe from the vehicle but also to fire their weapons from it without having to dismount or to expose themselves to an undue extent. Passengers are seated back to back, down the centre line of the carrier facing outwards. Overhead cover is provided by hinged hatches which fold back to provide good observation. The upper part of the sides slope inwards towards the flat roof and when the hatches are open the superstructure of the carrier provides more protection for the passengers when using their weapons than do most other vehicles of this type. Two large doors, one for each bank of passengers, are provided in the rear plate and the superstructure carries a one-man turret which can mount either a 12.7 or a 7.5mm MG. Armoured protection varies from 40 to 15mm, the same as that carried by the light tank and confers on the two, when operating together, the same opportunities for joint action as that enjoyed by Kangaroos and Sherman tanks in battles during World War II. AMX VTT has proved a most successful vehicle and is extensively used not only in France but also by the armies of many other countries.





*British Universal carrier, experimental version of 1948, showing the limited load space.*



*LVT(A)1 coming ashore. (top right,*

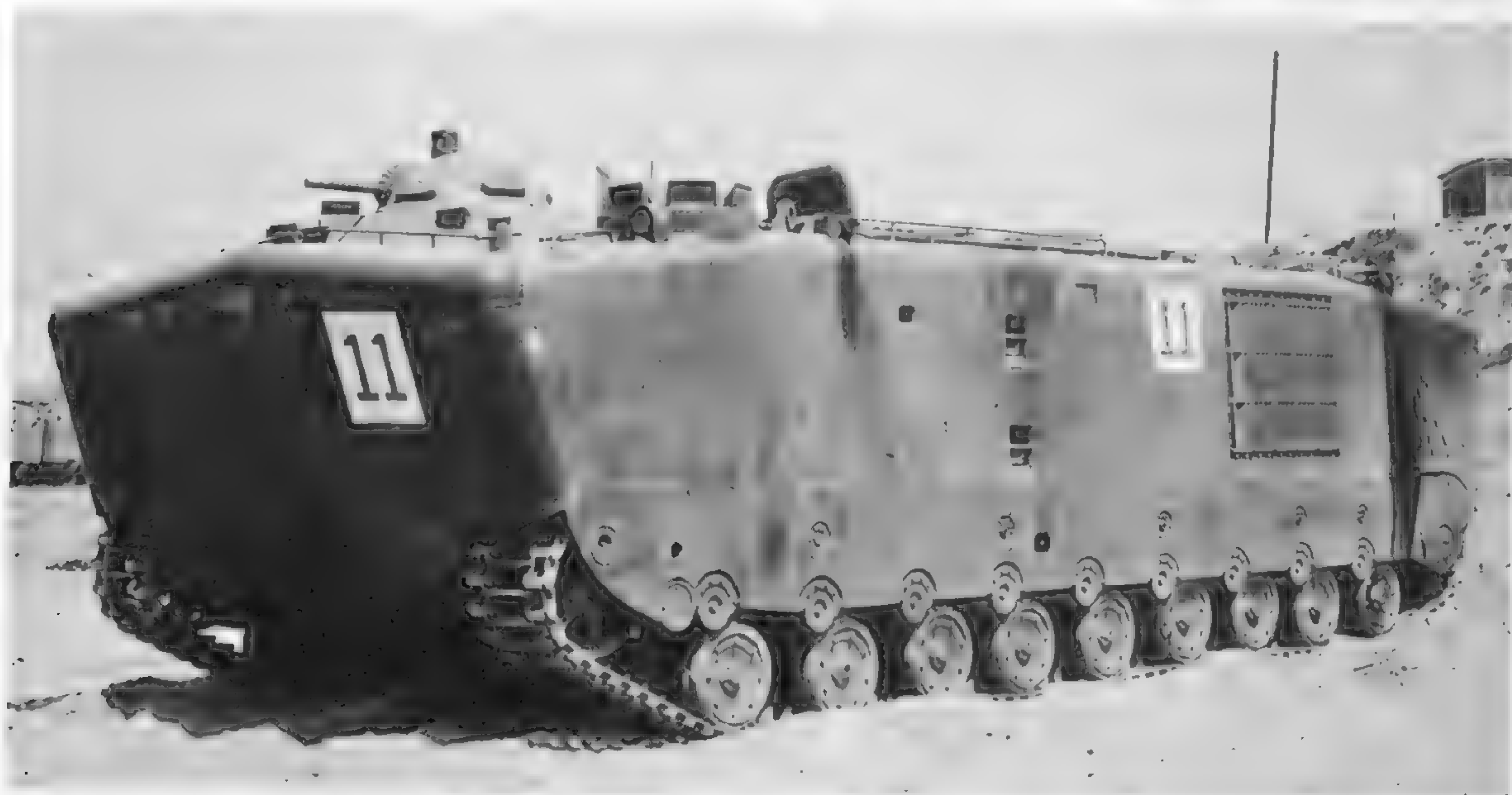


*LVT4 of 79th Armoured Division with a bit of extra armament! The LVT 4 was the LVT 2 with the engine moved forward and with a stern ramp. Both were used by the British in North-West Europe and Italy and were known as Buffaloes in NW Europe, Fantails in Italy.*

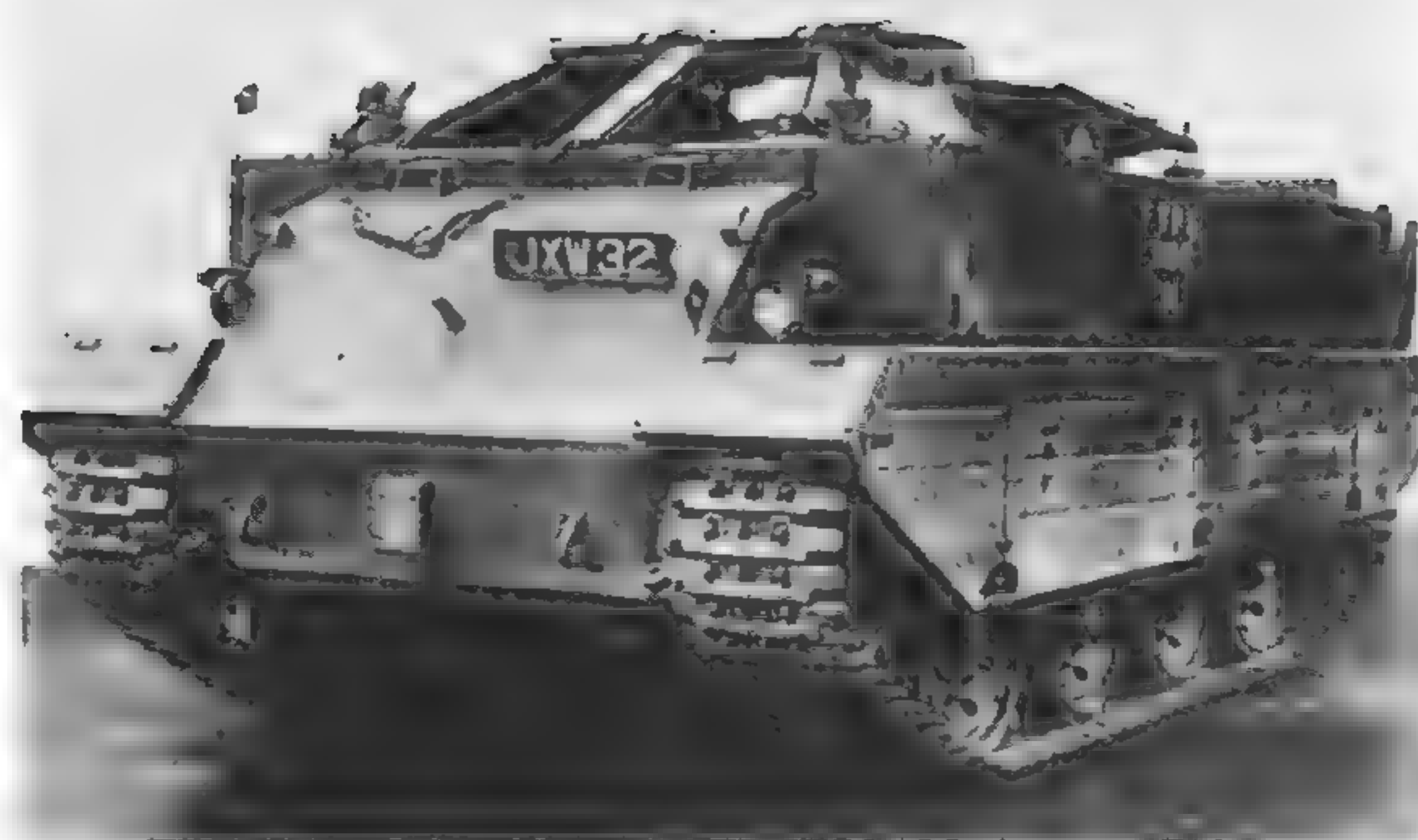
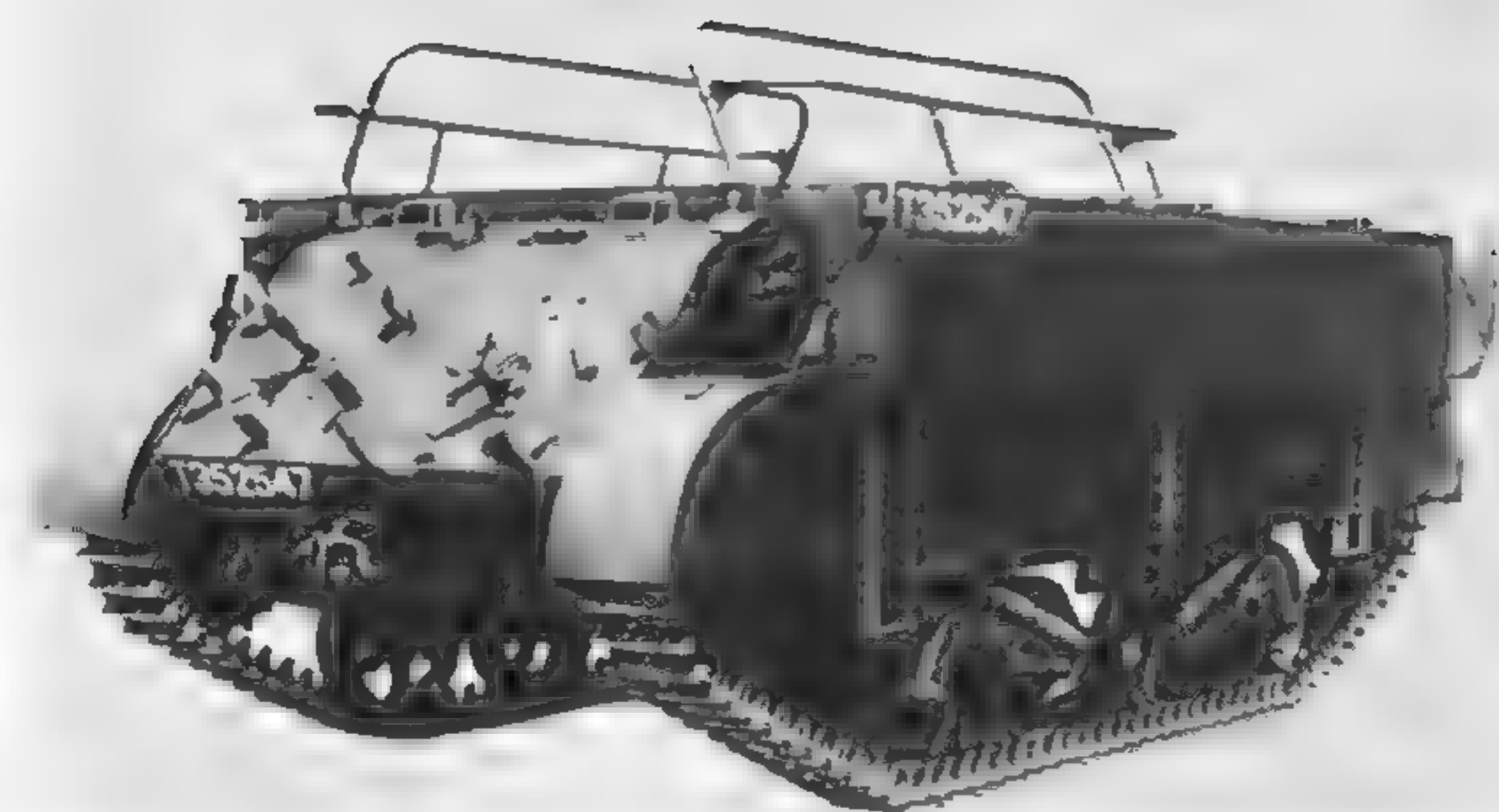
*LVTP5 fitted with a mine-sweeping rake in use by U.S. forces in Vietnam.*



*Bow view of the standard LVTP5 showing the inverted-V cut into the bow located ramp, the .30 machine-gun in the cupola, and the driver's vision device to the left of the cupola.*  
(U.S. Marine Corps)

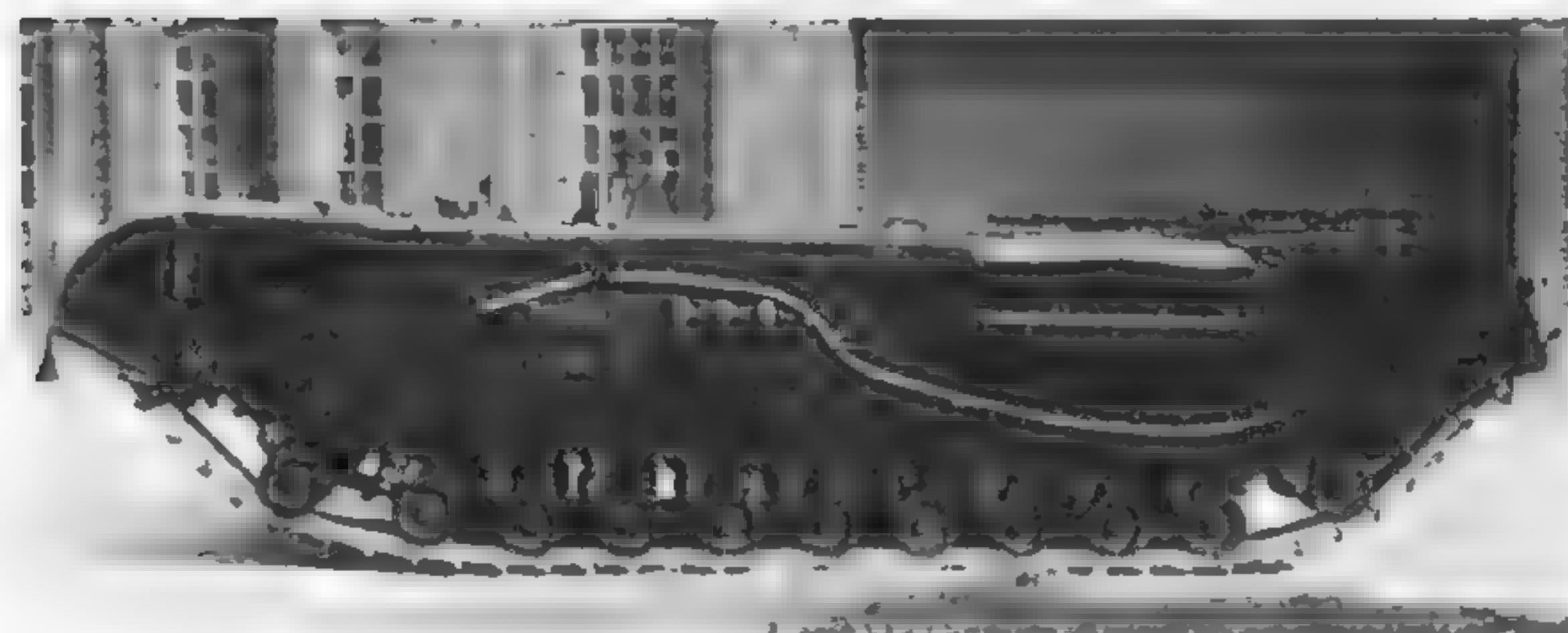






*FV 401, the Cambridge carrier, appeared in prototypes only. Passengers would have had to go into action over the sides of the vehicle. (top left)*

*Carrier, Tracked CT20—the Oxford carrier. It appeared in 1947, but only some 400 were built. (top right)*



*An attempt to adapt the Churchill tank chassis to the APC role. The Churchill is a Mark VII.*

## GERMANY

German pre-war military doctrine called for the closest possible cooperation between tanks and infantry. The need for some armoured vehicle to carry the foot soldier forward so that the pace of the tanks should not be slowed down because no one was available to take advantage of their gains, was appreciated at a very early date. A series of half and three-quarter tracked vehicles was built before the war and these were gradually improved and altered in the following years. The general design embodied a chassis with normal front wheel steering and a tracked assembly whose front idler came immediately behind the front wheel; a back driving sprocket was attached to the outer ends of the back axle. The track was carried on interleaved suspension wheels and no return rollers were used. Bodies varied in the amount of armour that was provided but ultimately they gave protected transport for a dozen men who were immune from rifle bullets and shell splinters from the side, although there was no overhead cover.

These vehicles were used for all sorts of duties in the German Army but, although the intention was to provide enough to lift the infantry in a Panzer division, this ideal was never realised. However, enough were available to confirm the German view of the need for armoured mobility for the infantry, quite apart from the opportunities they had for studying the subject from the other side.

When the German Army was re-raised there was an urgent demand for carriers for the infantry. Despite the disbelief of other nations the Germans attached great importance in post-war days to the combat carrier and would have nothing to do with the idea of the battle taxi. To meet requirements the HS 30 carrier appeared in 1959, based on a private venture by Hispano Suiza, which was accepted into service as SPz 123 despite the inherent disadvantages of a rear-mounted engine.

HS 30 was a foot lower than the U.S. M113 carrier, with a good ballistic shape and relatively thick armour—30mm in front at 55 degrees and 15mm on the sides. A revolving turret mounted a 20mm cannon but no provi-

sion was made for passengers to use their weapons while mounted; overhead cover was provided but, as already noted, troops going into dismounted action had to do so over the sides. It is possible that HS 30 was put into production too soon in order to meet the urgent demand for equipment and that better results might have been obtained had more time been available for development. HS 30 carried eight men and the lower silhouette was achieved at the cost of amphibious ability.

The Schützenpanzer neu, Marder, which appeared in 1968 was another combat carrier with a turret mounting a 20mm cannon and was provided with firing ports in the sides for the use of the passengers. It is based on a carrier HW-K11 which was unarmed but had a front-mounted engine and rear exits. The Marder has a good ballistic shape and the same thickness of armour as carried by HS 30. It has no swimming ability and to enable it to cross water obstacles provision is made for a Schnorkel tube enabling it to cross rivers up to 16 feet deep.

## JAPAN

The Japanese built several armoured carriers before and during World War II and design was to some extent influenced by the amphibious operations which they undertook against the Chinese from 1936 onwards. For land use they built a three-quarter tracked carrier on the lines of the current German vehicles, while in 1941 they built in prototype form a 12-ton carrier based on the design of their light tanks. This vehicle was supposed to carry up to 12 tons in weight and alternatively could carry men, although there was no recorded instance of their use in the APC role. 1944 saw the appearance of an amphibious carrier, HOKI, which could carry 12 men. It had a front-mounted engine and a rear exit, but except for armour round the driver and the MG posts, it had no protection. Katushka, an amphibious carrier, could carry 12 men but was unarmoured except round the driver and the machine-guns. These earlier versions are interesting for they show recognition of the requirement for a tracked vehicle which could transport either men or



stores, if necessary, under fire. There is no recorded instance of their employment in the true role of an APC.

However, with the re-creation of the Japanese Army a very different attitude to the APC is noticeable and the SU 60 armoured carrier was one of the first vehicles to be built by Japan's revived armament industry. In external appearance this carrier resembles the U.S. M113. It carries an externally mounted 12.7mm machine-gun, which cannot be fired without self-exposure by the gunner, and it also mounts a rifle calibre machine-gun in the front plate. A rear exit is provided for the six passengers who sit behind the engine compartment; the gunner sits alongside the engine and the commander is in front. It is nearly two feet lower than the U.S. counterpart but this reduction in external size means that it forfeits all inherent buoyancy and is incapable of swimming across water obstacles.

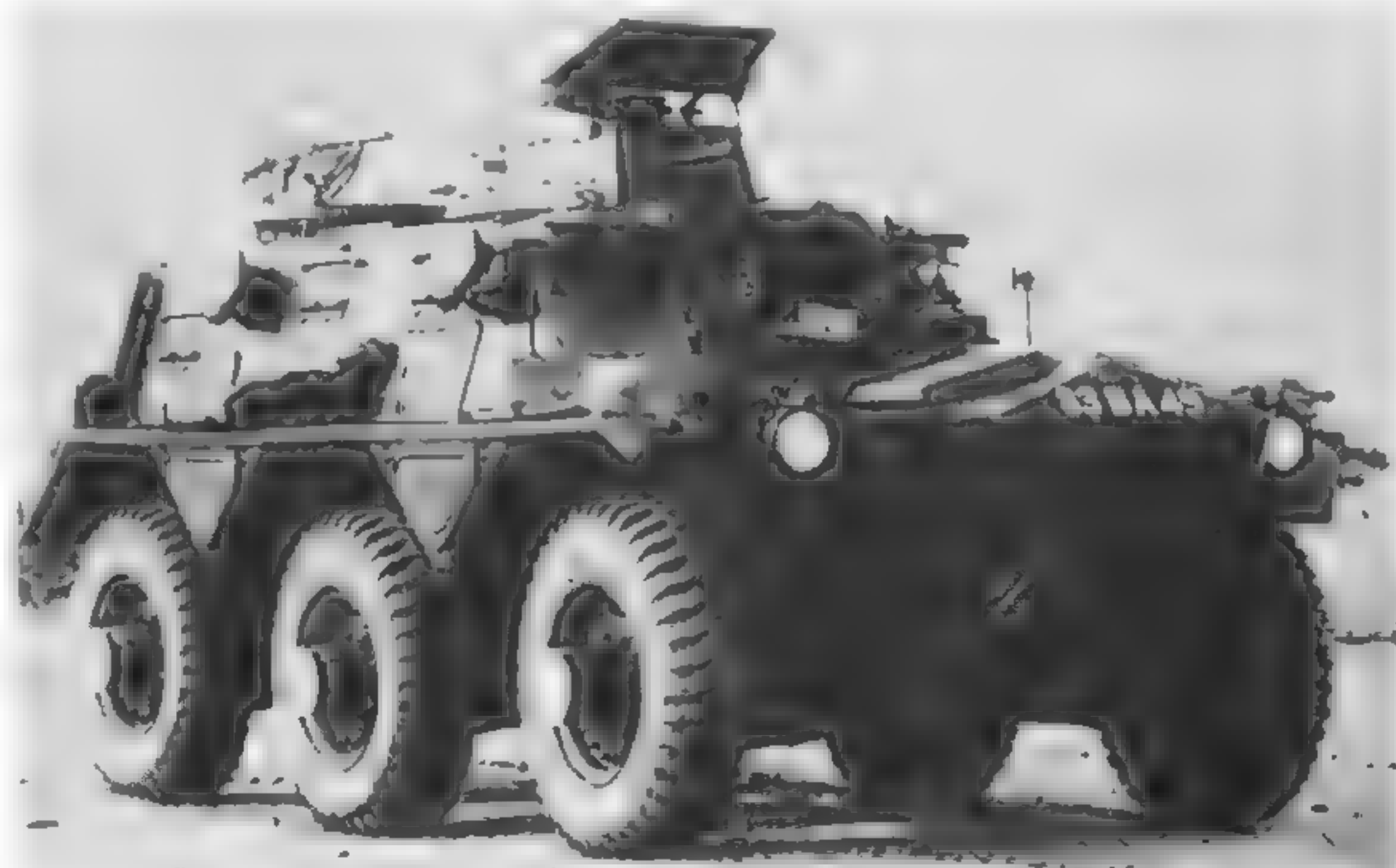
## SWEDEN

Sweden followed war-time precepts and converted a tank into an APC. However, this was no extemporised affair but involved a complete reconstruction of the chassis.

*Saracen APC showing the gun turret, the open Bren, and the firing ports in the sides.*

Swedish tanks lacked gun power and to remedy this the Strv 71 (M42) was upgunned to take a high velocity 75mm gun. In consequence the earlier tank M41 was so undergunned that it was no longer fit to take its place on the battlefield. Mechanically it was an excellent vehicle and after conversion made a most satisfactory personnel carrier. The alterations were extensive and involved moving the engine from the rear of the chassis to the front, altering the transmission and raising the sides of tank to provide overhead cover and shelter for eight soldiers. A rear door was provided and the completed vehicle was given a small turret with an externally mounted 12.7mm MG, controlled from the inside. This is almost the only successful conversion of a tank to an APC but Pbv 301, its official designation, lacked any swimming capacity.

The appearance of Pbv 301 in 1961 was followed by that of Pbv 302 in 1963. This machine was designed as an APC from the start and is lower than its predecessor although it can carry 10 men who sit facing inwards. The carrier is armed with a 20mm gun and a coaxial MG in a small revolving turret on the left hand side. Overhead



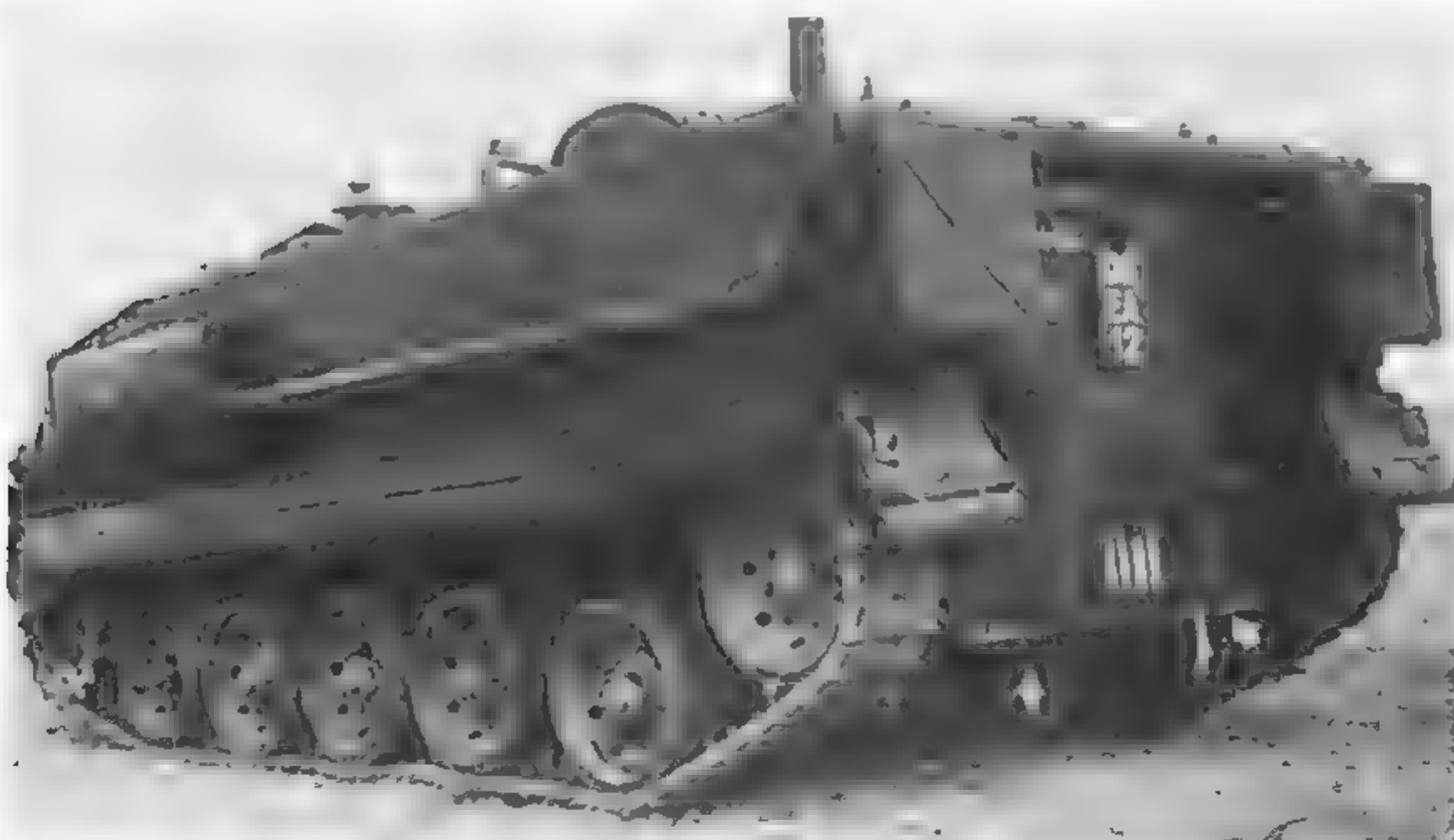
*FV 432 (three-quarter right front view) equipped as a sonic detection vehicle.*  
(Clive W. Moggridge)



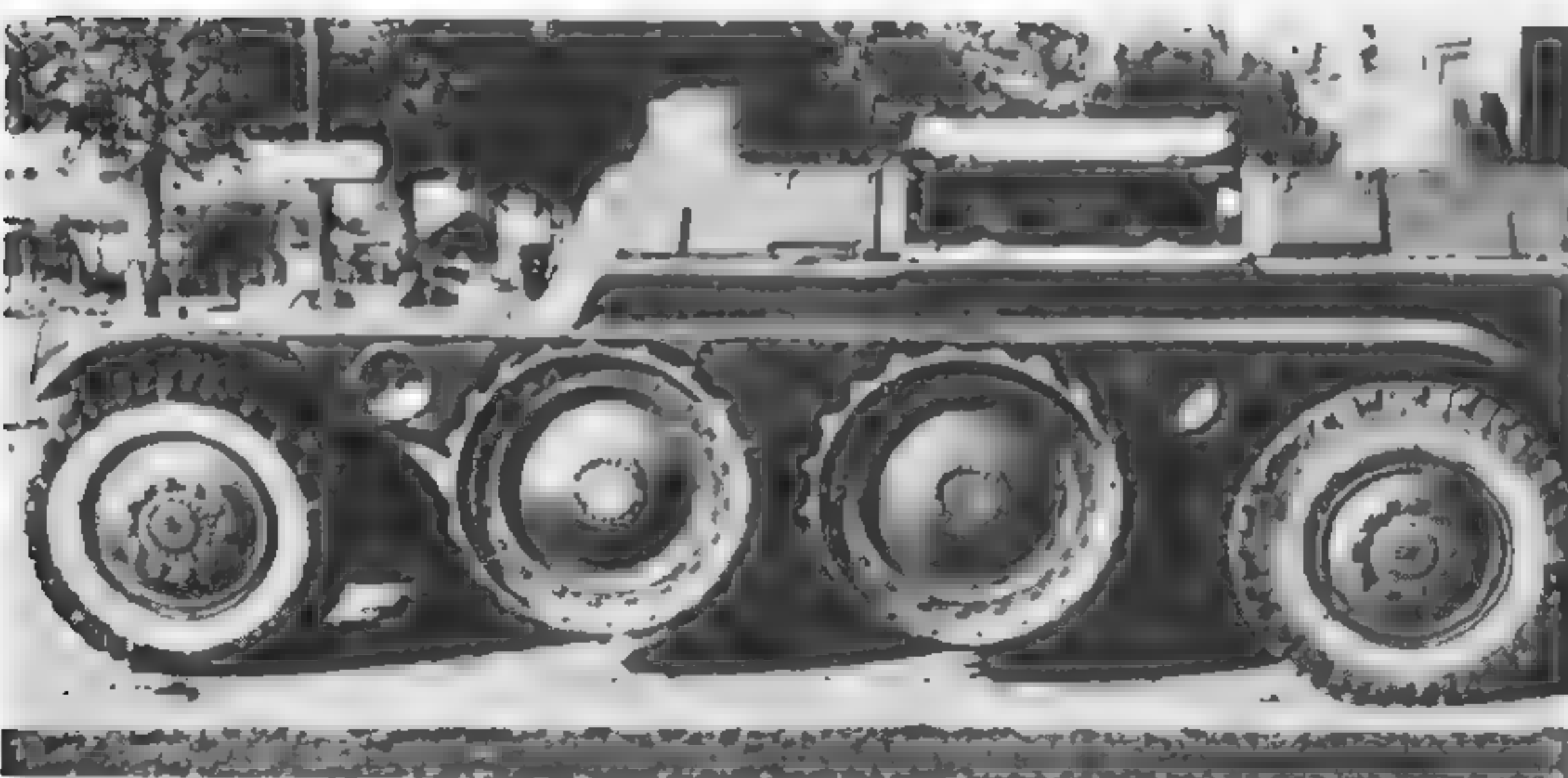




*HS 30 (or SPz 12-3) carrier to the left of a German Leopard tank.*



*Rear view of FV 432 with extension fitted to exhaust pipe. (C. F. Foss)*



*AMX-VTT showing gun turret, back to back seating, and rear exits.*

*The E.B.R. (Engin Blindé de Reconnaissance) Sahara armoured personnel carrier, based on the eight-wheeled Panhard armoured car. The inner wheels are raised off the ground for road operation.*

cover is provided for the passengers by folding hatches which are hydraulically operated: when opened personal weapons can be used although this involves considerable exposure for the firers, more so than in the case of the French AMX VTT carrier.

Pbv 302 is amphibious and has a thin outer skin over the armour plate which provides the necessary buoyancy and also gives the vehicle a better shape when water-borne. A trim vane hanging forward from the edge of the glacis plate assists general balance of the carrier in the water. It has a reputed speed of 4 knots when afloat, propulsion being by track. Rear doors are provided for quick exit and the general layout has been helped by the clever way in which the horizontally opposed 230 hp.







*Pbv 301 was a conversion from the Strv m/41 tank, which was itself based on the Czech TNH light tank. (Pbv = Pansarbandvagn, or armoured personnel carrier).*

Volvo engine has been placed below the floor. Pbv 302 is a very good vehicle, clearly designed to take its place on the battlefield and capable, at need, of engaging light opposition without tank support.

## SWITZERLAND

German operations in the Ardennes in 1944 abruptly revised the definition of impassable tank country and immensely widened the possible areas of armoured operations. Switzerland realised that much of the territory hitherto regarded as tank proof actually offered considerable scope for AFVs, and consequently set about building them in the 1950s. Concurrently with their tank construction they began to build APCs, appreciating the need for mobility for the infantry so that they could take advantage of the opportunities created by armoured action.

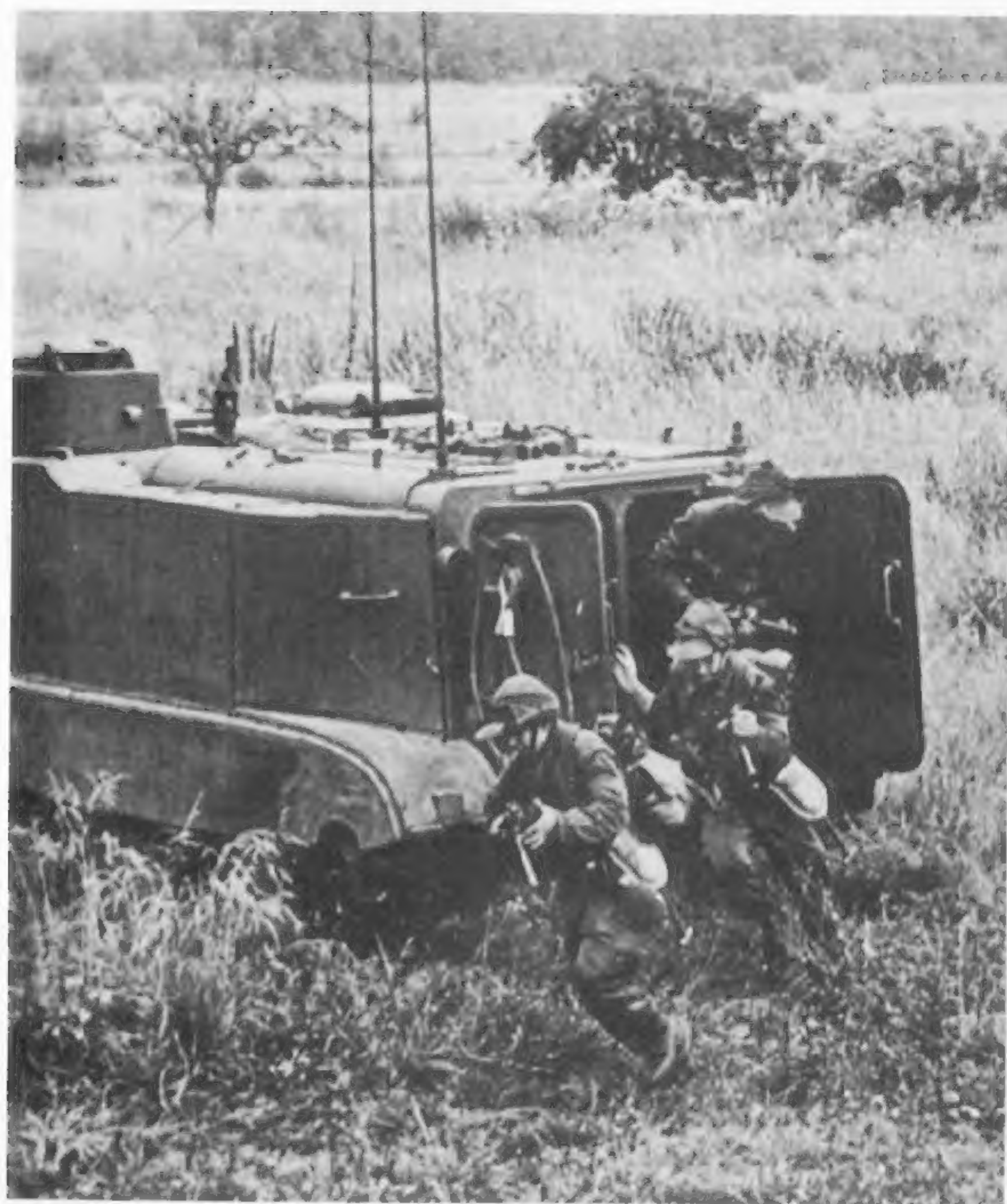
Development began with two four-wheel drive carriers which appeared in 1954 and 1959 respectively, which could carry a driver and six men. Their task was to carry their passengers as far forward as possible without becoming embroiled in the actual battle and they proved successful in this role within the limits imposed by the four-wheel drive.

A tracked carrier built by Saurer appeared in prototype form in 1958. It could carry 10 men and was armed with a turret mounted 20mm gun but it never came into

service. The same year saw the appearance of the Swiss-built tracked machine the Mowag Pirat 12. This weighed 12.5 tons and could carry eight men. No firing ports were provided but there was a turret mounted machine-gun; the body was not very satisfactory and there was consequent delay and exposure for the passengers when they disembarked, a curious defect with the front mounted 250 hp. Rolls-Royce petrol engine. This model never went into large scale production but was followed two years later by Mowag Pirat 14, weighing 14 tons and able to carry 12 men. A 20mm gun was mounted but except for the larger body and thicker armour there was virtually no difference between models 12 and 14, which, again, never went into production.

The machine which did come into service was the Mowag Pirat 18. This appeared in 1962 and could carry 12 men including a crew of two or three: it was armed with a 20mm gun in a turret with all round traverse and in addition mounted two machine-guns remotely controlled from inside: no firing ports were provided. This carrier has two rear doors and the layout is unusual with the engine centrally placed, and the turret in front of it; the commander sits alongside the driver and is in direct touch with the gunner and also with the passengers. The petrol engine used in the earlier Mowag Pirats has been replaced with a 10-cylinder CI engine giving 430 hp.: as the carrier only weighs 18½ tons this results in a good power-weight ratio giving a good operational performance.





*Three-quarter right front view of Pbv 302.*

(Hagglund)

*Riflemen dismounting into action from the rear of a Pbv 302.*

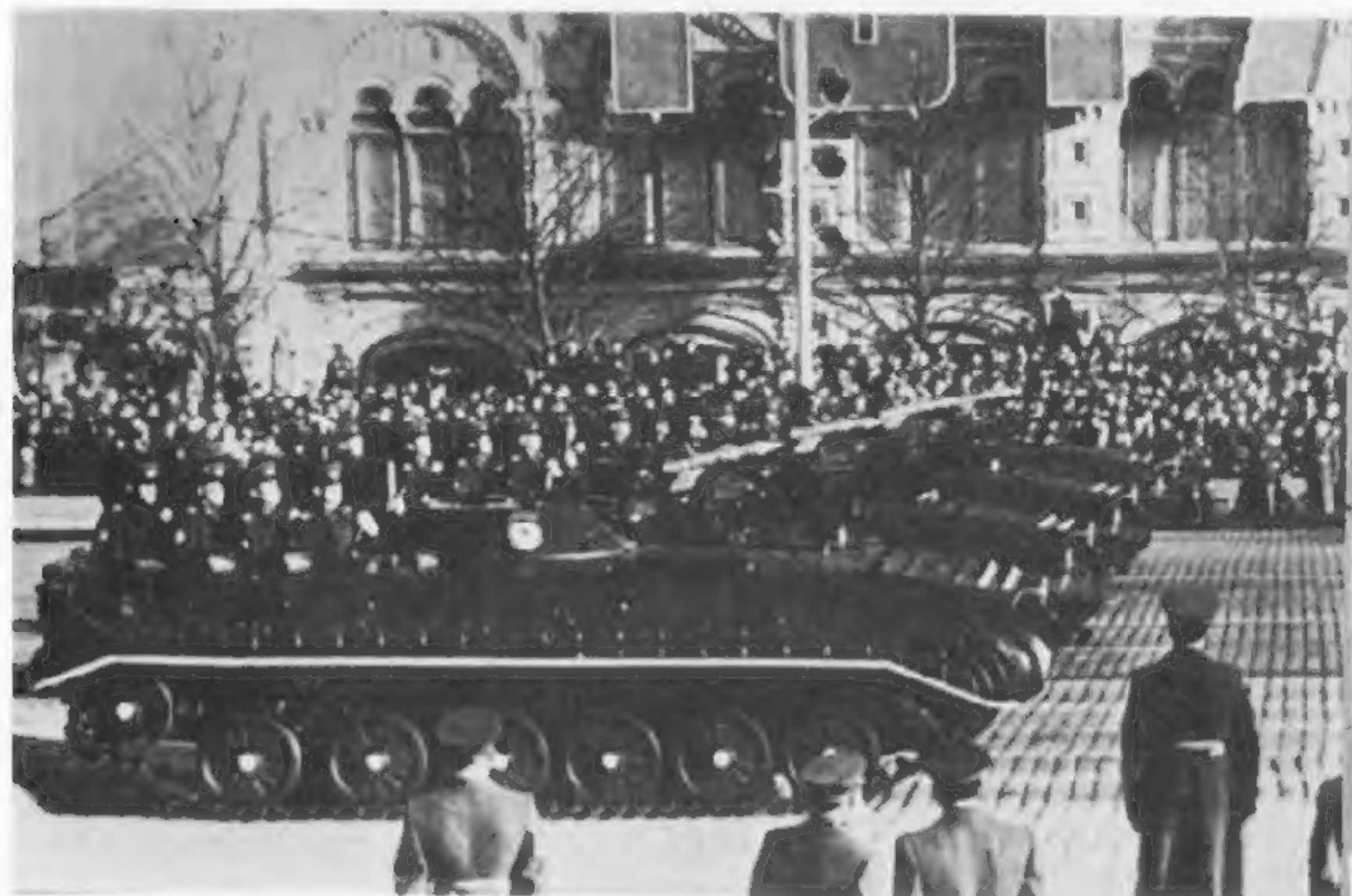
(Swedish Army)

### U.S.S.R.

Curiously enough the Russians have made no spectacular progress in building APCs despite their early appreciation of the need for infantry to be forward with the tanks to take advantage of any opportunities which may occur. The carriage of infantry on the outsides of tanks was common practice to such an extent that grab rails on the turrets and superstructures were normally provided.

Two versions of a 4 x 4 armoured carrier for infantry, one of which was able to swim, were built and this was followed by a 6-wheeled version which resembled the White Scout car built by the U.S.A. The six-wheeled cars were succeeded by an eight-wheel model which looked rather like the German eight-wheeled chassis. It was fitted with an open body without head cover and could carry eight men in addition to a driver and a commander. A 12.7mm and two rifle calibre MGs were mounted with limited traverse and with no protection for the gunners. This vehicle could swim.

*The BTR-50P (Bronietransporter 50 Plavaushiy) is a variant of the PT-76 light tank. This APC is fully amphibious and in the water is propelled by two water jets at the rear.*



A tracked APC which is in general use has been developed from the PT-76 tank. The turret has been removed and the superstructure sides have been raised to provide room for six passengers in addition to the vehicle crew of three. The early models appeared without any head cover for the passengers but later versions have hinged flaps. No provision is made either for observation from the inside of the carrier or for the passengers to use their weapons without exposing themselves above the top of the superstructure. An observation port on the left-hand side of the driver is provided for the commander; this is furnished with a number of fixed episcopes and has a round circular lid.

This APC, BTR 50, has one considerable advantage over others: the vehicle has been developed from a tank which is amphibious and is provided with water jets as a means of propulsion when afloat. On land the jet orifices are sealed by hinged covers but are instantly available when these are raised. They give a higher speed than any system relying on track propulsion can obtain and the vehicle is therefore able to tackle fast running water without difficulty. The instant readiness of this carrier for water-borne operations saves time in comparison with any other version which uses a flotation screen; a factor to be offset against the absence of any rear exit and the consequent need to go into action over the side of the vehicle.

*Note: Many of the APCs included in this synoptic view of the history and development of armoured personnel carriers are illustrated and examined in detail in other Profiles specifically devoted to particular vehicles and series of vehicles.*

*Except where otherwise credited all photographs are via the Royal Armoured Corps Tank Museum.*

**AFV/Weapons Series Editor:  
DUNCAN CROW**



# AFV/Weapons Profiles

*Edited by DUNCAN CROW*

FUTURE TITLES WILL INCLUDE:

## **PT-76**

*by Christopher F. Foss*

The Russian amphibious light tank and its variants, including the BTR-50 series, the ASU-85, and the BMP-76PB.

## **Russian Armoured Wheeled Vehicles**

*by John F. Milsom*

Although little attention was paid by the Russians to the development of armoured wheeled vehicles in the USSR during World War II, since the end of that war an extensive range of such vehicles has appeared, inspired predominantly by the appearance of the armoured personnel carrier.

## **The MBT70/XM803**

*by Colonel Robert J. Icks*

The history of the MBT70, the battle tank that was to be jointly designed and produced by the United States and the Federal Republic of Germany, involves the history of the T95, M60 and M551 vehicles, as well as the German Leopard and the French AMX-30. This particular Profile is prefaced by an account of the U.S. T95 Medium tank

series (also by Colonel Icks). The M60 appears in AFV/Weapons Profile 24, the M551 Sheridan in the next Profile after the MBT70. The Leopard and AMX-30 have been the subjects of AFV/Weapons Profiles 18, 19 and 63.

## **The M551 Sheridan**

*by Colonel Robert J. Icks*

Although the Sheridan was intended to replace both the M41 Light tank and the M56 Self-propelled gun, it was not intended as a light combat tank but rather as a light reconnaissance vehicle having sufficient firepower to participate in an airborne assault. Its weapon was a new gun/launcher nicknamed the Shillelagh. It served in Vietnam – with mixed results.

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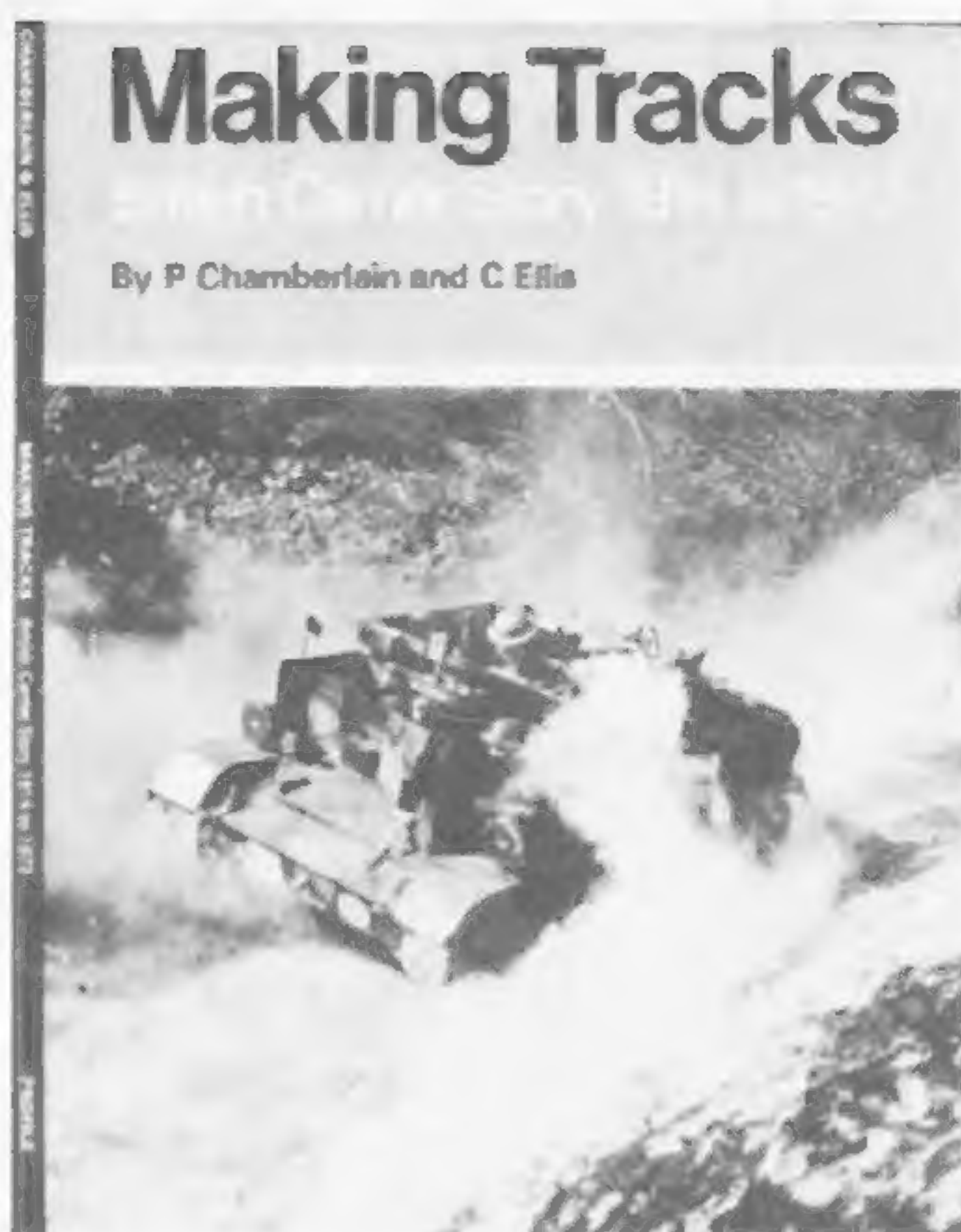
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